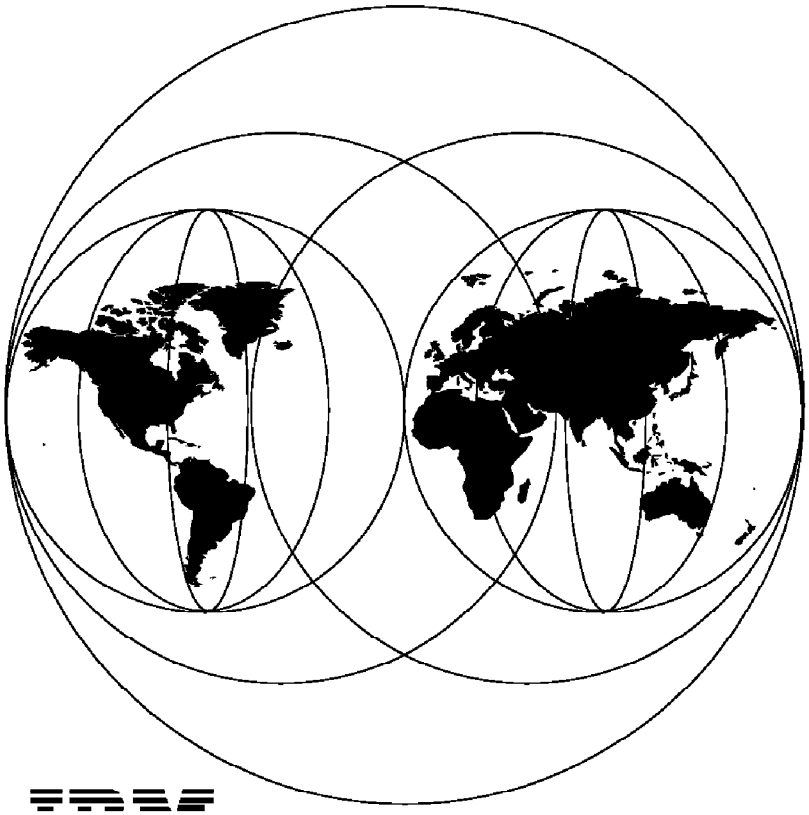
SG24-4726-00

IBM 2217 Nways Multiprotocol Concentrator Release 2 Installation Guidelines

November 1996



IBM

International Technical Support Organization
Raleigh Center

International Technical Support Organization

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Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix A, “Special Notices” on page 275.

First Edition (November 1996)

This edition applies to IBM 2217 Nways MpC Release 2.0.

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Contents

Preface

This redbook focuses on the new functionality and enhancements implemented in IBM 2217 MpC. It provides information about installation and configuration of the IBM 2217 Nways MpC Release 2.0 using the new implemented architectures, such as High Performance Routing, dependent LU requester (DLUR) and enhancements to the multiprotocol support.

This redbook was written for technical professionals, including systems programmers and network administrators, who need to know the new functions provided in this release. Some knowledge of the previous IBM 2217 MpC release is assumed, as well as a basic understanding of networking concepts and terminology used in the Systems Network Architecture (SNA), TCP/IP and the Multiprotocol Transport Networking (MPTN) architecture.

How This Redbook Is Organized

This redbook contains 287 pages. It is organized as follows:

- Chapter 1, “Introduction”

  This chapter is an overview of the networking functions available in the IBM 2217 Nways Multiprotocol Concentrator Release 2. In this chapter, new architecture upgrades and functions implemented in this release are briefly described. Later chapters provide more specific information on the most important line items included. You may want to read this chapter if you are interested in having a basic overview of the new functionality provided by the IBM 2217 Nways Multiprotocol Concentrator Release 2.

- Chapter 2, “SNA Enhancements”

  New architecture upgrades have been included in the IBM 2217 Nways Multiprotocol Concentrator Release 2 to improve networking performance when using APPN networks. You will find here the basis of the new HPR architecture and how to configure the function in your network when using the IBM 2217 Nways Multiprotocol Concentrator Release 2 in order to run native client/server SNA applications using the APPC and CPI-C APIs or when using APPC as a transport for other protocols such as TCP/IP, NetBIOS and IPX. The IBM 2217 Nways MpC Release 2.0 is configured as a network node (NN) in this case.

- Chapter 3, “SNA over IP Gateway”

  This chapter describes the configuration steps required to configure the IBM 2217 Nways Multiprotocol Concentrator Release 2 as an SNA over TCP/IP Gateway. This function allows your APPC and CPI-C applications to access the IBM 2217 Nways MpC Release 2.0 using TCP/IP networks.

- Chapter 4, “SNA Gateway for Dependent LU Sessions”

  This chapter describes the installation process of the SNA Gateway function. In this chapter, there is information on how to configure the dependent LU requester (DLUR) support included in the SNA Gateway. If your system is not prepared to run DLUR, a configuration using cascaded SNA Gateways is also presented.

- Chapter 5, “Sockets Applications over SNA”

This chapter describes the AnyNet Sockets over SNA function of the IBM 2217 Nways Multiprotocol Concentrator Release 2. It shows you what you need to do to be able to run sockets applications over an SNA network as well as accessing sockets applications residing in other IP networks. It includes the configuration process for the Sockets over SNA gateway function provided in the IBM 2217 Nways Multiprotocol Concentrator Release 2.

- Chapter 6, “NetBIOS Applications over SNA”

  In this chapter, we give you an overview of the NetBIOS over SNA function provided by the IBM 2217 MpC. It includes a sample scenario and shows you how to configure the IBM 2217 MpC in order to run NetBIOS applications over SNA networks. Filters and NetBIOS name qualifiers are also described in order to select specific NetBIOS traffic.

- Chapter 7, “IPX Applications Over SNA”

  This chapter provides basic information on how to run IPX applications over SNA. We include a sample configuration and how to use filters and name qualifiers in order to select specific IPX servers and services.

- Chapter 8, “SDLC Data Link Control - Configuration”

  The SDLC as a WAN protocol is presented in this chapter. It includes a sample configuration for a leased SDLC line as well as for a switched SDLC line.

- Chapter 9, “X.25 Data Link Control - Configuration”

  In this chapter, X.25 is configured as a WAN protocol. A sample configuration is provided using the Remote Control Utility (RCU).

- Chapter 10, “Frame Relay and Source Route Bridging”

  IBM 2217 MpC support for the frame relay as a WAN protocol is presented in this chapter. A configuration using the WAC adapter is included. One of the most important functions of frame relay is the support of the High Performance Routing (HPR) capability of APPN. Frame relay also supports source-route bridging (SRB) which allows you to bridge LAN protocols.

- Chapter 11, “ISDN Support in IBM 2217 MpC”

  IBM 2217 Nways MpC Release 2.0 has included support for Integrated Services Digital Networks (ISDN). In this chapter we show you how to configure ISDN connections using the B-Channel (SDLC and X.25) and the D-Channel (X.25 only).

The Team That Wrote This Redbook

This redbook was produced by a team of specialists from around the world working at the Systems Management and Networking ITSO Center, Raleigh.

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Comments Welcome

We want our redbooks to be as helpful as possible. Should you have any comments about this or other redbooks, please send us a note at the following address:

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Your comments are important to us!

Part 1. Introduction

Chapter 1. Introduction

This chapter gives you a brief overview of the functions provided by the IBM 2217 Nways MpC Release 2.0. It also describes some of the scenarios included in this redbook. For more detailed information, please see *IBM 2217 Nways MpC User's Guide, Release 2*, GC30-3706-01.

1.1 Base Hardware

The IBM 2217 MpC is a hardware platform for which many hardware features and combinations of features can be ordered. This section describes the components of the base platform and features.

Base hardware is considered to be that hardware which is shipped from the factory on or with the IBM 2217 MpC unless other hardware is specified in the order. Features are usually optional, and each feature is identified by a four-digit feature code.

The base hardware for the IBM 2217 MpC includes:

- The system board and processor module (50-MHz 486DX2 or Pentium 75 MHz)
- A power supply
- A fixed disk
- 16 MB of memory
- A diskette drive
- Fans
- An external modem (in the U.S., Canada, and some other countries)

The system board contains a zero-insertion-force (ZIF) socket for the processor module. A three-slot riser card provides connections for:

- WAC Adapters (X.21, V.35, EIA 422/449, EIA 232/V.24)
- A Token-Ring 16/4 ISA Adapter
- An Ethernet ISA Adapter
- An ISDN Basic Rate Interface Adapter

The system board also has connections for:

- The diskette drive cable
- The fixed disk drive cable
- The external serial port

The fixed disk is a direct access storage device. It is preloaded with the control code. The fixed disk mounts on the frame and has a separate power connector to the power supply.

Two 8-MB Single Inline Memory Modules, or SIMMs, are plugged into the memory slots on the system board.

The diskette drive has a capacity of 1.44 MB. It uses a standard double-sided, high-density 3.5-inch removable diskette. The drive motor is +12 volts direct current (V dc), direct drive (nonbelt). The +12 V dc motor is hardware-controlled and is switched on only when drive access is required.

A modem is required for the remote service of this product. A 28.8 kbps, V.34, asynchronous, Hayes-compatible external modem is provided with the IBM 2217 MpC in the U.S., Canada, and some other countries; contact your IBM representative to determine whether an external modem will be shipped to your country with the 2217. If an external modem is not included in the shipment, the customer must provide an external modem with a minimum speed of 14.4 kbps. This modem attaches to the serial port on the rear of the machine. Only modems meeting the requirements shown in the Appendix (External Modem) of the *2217 Nways Multiprotocol Concentrator Planning Guide* are acceptable.

Performance Package 1 and Performance Package 2 allow you to increase the data handling capacity of the 2217. Performance Package 1 is available on the Model 200, while Performance Package 2 is available on the Model 300.

1.2 Overview of the IBM 2217 MpC Functions

The following figure illustrates the different protocols the IBM 2217 MpC can transport over SNA. Other protocols can also be bridged using the source route bridging function of the frame relay support provided by the IBM 2217 MpC.

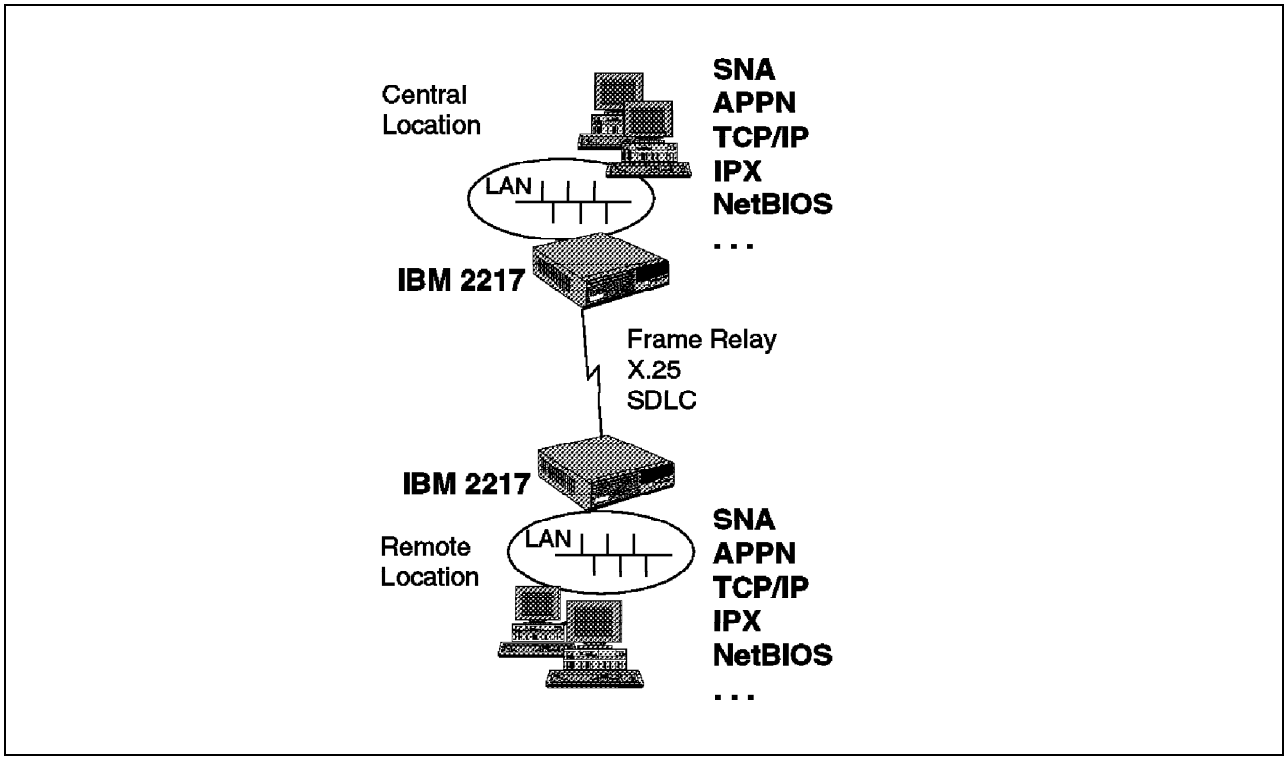


Figure 1. 2217 in a Point-to-Point Configuration

In Figure 2 on page 5 we describe 2217s connected to an existing 37XX network using SNA.

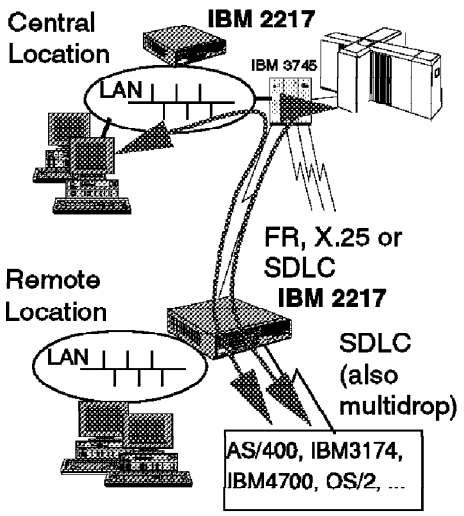


Figure 2. IBM 2217 MpC Connected to an Existing 37XX Network

1.2.1 IBM 2217 MpC As an End Node (EN) or Network Node (NN)

The IBM 2217 MpC can be configured as an APPN network node (NN) or an APPN end node (EN). The IBM 2217 MpC operates as a low-entry networking node (LEN) when it is configured as an end node without a network node server.

A node type of NN is required for:

- Intermediate session routing
- The SNA over IP Gateway function

If you configure the IBM 2217 MpC as an end node and you want to connect the 2217 to a network node server that will provide APPN services to the 2217, you must configure an SNA logical link from the IBM 2217 MpC to the network node server. The logical link type must be NN.

1.2.2 The IBM 2217 MpC As a Dependent Logical Unit Requester (DLUR)

A DLUS (dependent logical unit server) is a VTAM network node that provides SSCP services for a dependent LU in its own or another APPN network. The DLUS provides:

- More flexible system definition
- Better network management
- Increased availability
- Improved routing

When configured as a DLUR, the IBM 2217 MpC supports all base DLUR functions and the following optional functions:

- TakeOver/GiveBack

This support enables LU-LU sessions to remain active during DLUR-DLUS connection failure. The connection can be reestablished with the same or another DLUS without disrupting the LU-LU sessions.

- MultiSubnet

  This support enables the DLUR node, DLUS node, and the node containing the application to be in different subnetworks.

- Backup DLUS

  When the connection to the primary DLUS fails or does not become active, the IBM 2217 MpC automatically attempts to connect with the backup DLUS.

DLUR enables dependent LUs (LU 0, 1, 2, 3, and dependent LU 6.2) to benefit from an APPN network. DLUR supports dynamic and multiple paths through the network and eliminates the need for dependent LUs (or their gateway) to be adjacent to the host or an NCP.

Any number of dedicated physical units (PUs) can be defined on the DLUR-DLUS connection. When configured as a DLUR and using the network management passthrough function, the IBM 2217 MpC can provide network management access to downstream workstations.

1.2.3 SNA Gateway and PU Type 2.0 Support

When the IBM 2217 MpC connects to hosts that support PU 2.0 workstations, it can simultaneously connect a dependent workstation to multiple hosts. By defining a logical link to each host, the IBM 2217 MpC improves network efficiency by using direct routes rather than cross-domain links.

The IBM 2217 MpC can also support multiple links to the same host. By defining multiple PU connections, each supporting 254 dependent LUs, the IBM 2217 MpC increases the number of LUs that can be supported.

1.2.4 IPX over SNA

At the link layer, IPX is a connectionless protocol. IPX relies on applications to advertise their services in order to find addresses. Routers pass the servers' advertisements around the network. These functions use service advertising protocol (SAP) and routing information protocol (RIP).

The IBM 2217 MpC obtains SAP and RIP information from the local LAN during startup and passes this information to each partner IBM 2217 MpC it connects to over the WAN. As SAP and RIP information is updated, the IBM 2217 MpC resends the information to each partner 2217. Repetitive SAP and RIP broadcasts that do not provide update information are filtered out and do not pass across the SNA network.

The IBM 2217 MpC IPX over SNA Gateway function does not require manual update of network topology information (SAP and RIP entries) when the network configuration changes, except when the local IPX network number changes. To limit the number of WAN broadcasts required for SAP and RIP entry updates, the 2217 regularly updates its tables. Approximately once every minute, the 2217 scans for network configuration changes. If the configuration has changed during the time interval, such as a server shutting down, the IBM 2217 MpC makes the appropriate changes to its tables and sends the changes to its partner 2217s.

The IBM 2217 MpC uses a single pair of LU-LU sessions to transport IPX traffic across the SNA connection. All IPX traffic uses the same transmission prioritization. If you are also running NetBIOS traffic between the 2217s, the IPX traffic uses the same LU-LU session pair as used by the NetBIOS traffic.

1.2.5 NetBIOS over SNA

The NetBIOS protocol uses Logical Link Control (LLC) Type 1 or datagram frames (connectionless) and LLC Type 2 or session (connection-oriented) frames. The protocol uses names for addressing. A requester broadcasts to a domain using a name to find a resource. When the domain controller or server responds, a few other LLC Type 1 frames flow. These frames include names for addressing. The workstations then initialize a session and begin using LLC Type 2 frames that have session numbers, but no names, for addressing.

The IBM 2217 MpC uses a single pair of LU-LU sessions to transport NetBIOS traffic across the SNA connection. All NetBIOS traffic uses the same transmission prioritization. If you are also running IPX traffic between the 2217s, the NetBIOS traffic uses the same LU-LU session pair as used by IPX traffic.

Most applications restrict NetBIOS resource names to 8 characters. Because frames on the LAN have 16 bytes reserved for the name field, applications can add a prefix or a suffix to the name that contains data for the applications' purposes. Because the resource name can be found anywhere in the 16-byte frame name, the IBM 2217 MpC uses an implied wildcard to determine the qualification of a destination name.

When a NetBIOS workstation locates a resource, it connects to the partner using LLC Type 2 (connection-oriented) frames. The IBM 2217 MpC acknowledges all frames sent to remote partners as those frames are received from the LAN; this allows the IBM 2217 MpC to satisfy the 802.2 timing parameters and hop-count restrictions for LANs. The IBM 2217 MpC logs the NetBIOS session, or circuit, and tracks the amount of data transmitted over the circuit.

1.2.6 Sockets over SNA

The IBM 2217 MpC Sockets over SNA Gateway function enables an IBM 2217 MpC to transport TCP/IP data between SNA and IP networks:

- Socket applications running on different IP networks can communicate across an SNA network.
- Socket applications running on an SNA network can communicate with Socket applications running on a native IP network.

TCP/IP data is routed over SNA using IBM's multiprotocol transport networking (MPTN) formats. LU 6.2 conversations are used to establish communication between Socket application programs.

1.2.7 SNA over IP

When configured to support SNA over IP, the IBM 2217 MpC enables an APPC application running nonnatively on an IP LAN to communicate with remote native or nonnative APPC applications.

Note: Nonnative pertains to the relationship between a tra nsport user and a transport provider. For a nonnative node, the user and provider use different transport protocols.

When configured as an SNA over IP Gateway, the IBM 2217 MpC acts as an endpoint for the TCP connection segments and sets up the SNA connection segment as a session across the SNA network.

Note: If the SNA network is using APPN protocols, the part ner LU is dynamically located. If the IBM 2217 MpC is attached to an SNA network through a low-entry node (LEN) connection, the location of the LU must be predefined.

When a native node in the SNA network issues a connection setup request, it generates a search request for the partner LU:

- If the network is APPN, the request generated is an APPN Locate request.
- If the network is subarea, the location of the partner LU must have been predefined at the native node. The native node sends a BIND request to the predefined partner LU.

When the 2217, which must be an APPN network node, receives the APPN Locate or SNA BIND, it processes the request using standard APPN or SNA flows. The IBM 2217 MpC also queries the domain name server of the IP network or the local hosts file to determine whether the partner LU is located in the IP network.

If the partner LU is located on a nonnative access node in the IP network, the IBM 2217 MpC creates a positive Locate response and sends the response to the source node. Using the information contained in the response, the source node sends an SNA session setup request to the 2217. The IBM 2217 MpC forwards this request over the IP network as an MPTN_Connect packet to the access node containing the partner LU.

The connection setup flows between the IBM 2217 MpC and the access node are the same as between two access nodes.

1.2.8 Source Route Bridging

The IBM 2217 MpC supports source route bridging over frame-relay networks and token-ring LANs. Source route bridging can be used:

- Over the IBM 2217 MpC token-ring LAN adapter port.
- Over the IBM 2217 MpC WAC ports when configured for the frame-relay protocol. This includes bridging between two WAC ports.

Therefore, up to five ports can be used for bridging in the 2217, depending on the 2217's adapter configuration.

In source route bridging, end stations find their communication partners by sending discovery frames (broadcasts). These frames are forwarded by the bridges. Each bridge passed on the way to the destination puts its address into a route information field in the frame header. This routing information is used by the end stations to communicate. Each data frame sent contains the bridge addresses it must pass.

Note: An IBM 2217 MpC that is bridging traffic can operate with other types of bridges, such as:

- Workstations running the Token-Ring Bridge/DOS Program for frame relay
- Workstations running RouteXpander/2
- 6611 network processors

When configured for source route bridging and using the supplied filter, the IBM 2217 MpC routes traffic for the protocols it supports (SNA, TCP/IP, IPX, and NetBIOS) and bridges traffic for the protocols it does not support. For example, DECnet and AppleTalk are bridged because the IBM 2217 MpC cannot route them. The IBM 2217 MpC uses the dedicated routing services of the protocols, expanding their routing areas to include an entire WAN.

Note: Disabling the routing of TCP/IP, IPX, and NetBIOS traffic using the IBM 2217 MpC RCU does not result in this traffic being bridged. To bridge traffic for SNA, TCP/IP, IPX, and NetBIOS, you must edit the supplied filter file, GSDSRB.INI, and remove the entries for these protocols.

Note

IBM 2217 Nways MpC Release 2.0 does not support transparent bridging for Ethernet LANs.

1.3 IBM 2217 MpC Models

Currently two models of the IBM 2217 MpC are available: IBM 2217 MpC Model 200 and 2217 Model 300.

The Model 200 supports:

- One LAN adapter
- One of the following configurations:
  - One WAC adapter
  - One WAC adapter and one integrated-services digital network (ISDN) adapter

The Model 300 supports:

- One LAN adapter
- One of the following configurations:
  - Two WAC adapters
  - One WAC adapter and an ISDN adapter
  - One WAC adapter

The following tables give you an overview of the possible configurations of both boxes and their capabilities.

1.3.1 Maximum Capacities

Processor/Memory	Model 200	Model 300
Standard processor	486DX-2/50	Pentium 75
Optional processor upgrade	486DX-4/100	-
Memory standard/optional	16/32 MB	16/32 MB
Adapter Slots *	3	3
WAC adapters ** X.21 (up to T1/E1) or V.35 (up to T1/E1) or RS-422/449 (up to T1/E1) or RS-232D/V (19.2 kbps)	1	2 ****
ISDN adapter **** ISDN BRI (2x64 + 16 kbps)	1	1 ****
LAN adapter Token-ring (16/4 Mbps) or Ethernet (10 Mbps)	1	1

Comments:

* The standard configuration has 2 slots populated with: one WAC adapter (2 ports) and one LAN adapter (1 port).
** The Wide Area Connector (WAC) adapter ports support a maximum speed of 2.048 Mbps when linked over frame relay or SDLC, and 64 kbps over X.25. The max aggregate speed of the two WAC ports is 2.048 Mbps.
*** ISDN B-channels support SDLC or X.25, D-channel supports X.25 (no frame relay over ISDN).
**** The ISDN BRI adapter is mutually exclusive with the second WAC adapter.

1.3.2 Supported Protocols

Protocol	Frame Relay	X.25 *	SDLC *	Token Ring	Ethernet
TCP/IP	Y **	Y **	Y **	Y	Y
IPX	Y **	Y **	Y **	Y	Y
NetBIOS	Y **	Y **	Y **	Y	Y
APPC-LU 6.2	Y	Y	Y	Y	Y
SNA- LU 0,1,2,3	Y	Y	Y	Y	Y
SR Bridging	Y	N	N	Y	N

Comments:

* X.25 and SDLC are also supported over ISDN.
** Data is carried in LU 6.2 sessions via an SNA/APPN backbone.

1.3.3 Functional Highlights

In this section, we list the functions provided by the IBM 2217 MpC.

1.3.3.1 IBM 2217 MpC Release 1 Functionality

Initial IBM 2217 MpC release 1 included the following functionality:

- Built upon AnyNet protocol conversion technology
- Multiprotocol LAN-to-LAN communication over:
  - Frame relay
  - X.25
  - SDLC
- Provides single protocol, fully meshed WAN backbone (standalone or with existing SNA/APPN network)
- Functionality of SNA/APPN network node provides:
  - High reliability
  - Class of service (priorities within backbone)
  - Find resources dynamically
  - Congestion control
  - Predictable response times
  - Data compression
  - High bandwidth utilization
- Supported (downstream) protocols:
  - TCP/IP
  - Novell IPX
  - NetBIOS
  - APPC/LU 6.2
  - SNA LU 0, 1, 2, 3
- Other protocols can be bridged over frame relay
- LAN broadcast filtering (IPX and NetBIOS)
- Shipped with pre-loaded hardfile (dual images)
- Remote Control Utility (RCU)
  - Initial configuration over modem or LAN
  - Later configurations over modem, LAN or SNA network
- SNMP network management agent
- SNA Network management via alert and status info

1.3.3.2 IBM 2217 MpC Release 2 Functionality

- Model 300 support
- High Performance Routing (HPR) support (FR and LAN)
- ISDN basic rate adapter support
- Any protocol (FR, X.25, SDLC) on any WAC port

- Higher SDLC upstream speed (T1/E1)
- Multiple PU images for gateway function (>254 LUs)
- Dynamic Sockets over SNA route updates
- RIP table updates for the local LAN attached IP devices
- Class of service transmission priority support
- Up to 16 multidropped SDLC devices downstream
- DLUR support for downstream nodes without DLUR
- Multiport bridging over frame relay ports
- Support for larger network topologies
- Microcode upgrade via CD ROM
- Central site microcode distribution to multiple IBM 2217 MpC
- Scheduled application of microcode updates

1.4 Supported Adapter Combinations on the IBM 2217 MpC

The slot numbers appearing in the following table are the numbers as you would see them from the rear of the box. (Slot 1 is the lowest; slot 3 is the highest.)

Table 1. IBM 2217 MpC Plugging Chart

Slot Number	Model 200	Model 300
3	LAN	LAN
2	WAC	WAC
1	ISDN or empty slot	WAC, ISDN, or empty slot

1.4.1 2217 Features

Many hardware features are supported on the 2217. These features, and combinations of them, enable the IBM 2217 MpC to support varied application scenarios. Features may be factory or field-installed. The name of each feature and its feature code are shown in Table 2 on page 13.

Table 2. IBM 2217 MpC Features	
Feature	**Feature Code**
Token-Ring 16/4 ISA Adapter	2216
Ethernet ISA Adapter	2226
First X.21 WAC ISA Adapter	2905
X.21 WAC ISA EIB	2906
First V.35 WAC ISA Adapter	2915
V.35 WAC ISA EIB	2916
First EIA 422/449 WAC ISA Adapter	2925
EIA 422/449 WAC ISA EIB	2926
First EIA 232/V.24 WAC ISA Adapter	2928
EIA 232 WAC ISA EIB	2927
ISDN Basic Rate Interface Adapter	3930
Performance Package 1	3000
Performance Package 2	3001
Second X.21 WAC ISA Adapter	3905
Second V.35 WAC ISA Adapter	3915
Second EIA 422/449 WAC ISA Adapter	3925
Second EIA 232/V.24 WAC ISA Adapter	3928

- **Token-Ring 16/4 ISA Adapter (F/C 2216):** The Token-Ring 16/4 ISA Adapter provides an IEEE 802.5 standard interface to an IBM Token-Ring Network. This adapter provides baseband communications at either 4 or 16 Mbps.

  One Token-Ring 16/4 ISA Adapter is supported by the 2217. The adapter is shipped with a conversion cable (P/N 60G1066) that plugs into the RJ-45 connector on the adapter. The standard token-ring adapter cable (P/N 6339098 or equivalent) plugs into this conversion cable.

  The part of the Token-Ring 16/4 ISA Adapter that can be seen in the slot contains two light-emitting diodes (LEDs), one amber and one green. These LEDs provide information useful for monitoring the status of the adapter and for problem solving. If the amber LED is off and the green LED is on, the adapter is operating correctly. If the amber LED is blinking and the green LED is on or off, the adapter has detected a potential problem.

- **Ethernet ISA Adapter (F/C 2226):** The Ethernet ISA Adapter provides an Ethernet Version 2 and IEEE 802.3 interface. This adapter supports the use of thick coaxial cable (10Base5), thin coaxial cable (10Base2), and twisted-pair cable (10Base-T).

  One Ethernet ISA Adapter is supported by the 2217. The attachment cables to the network are not provided with the product.

  The maximum length of thick cable between the transceiver and the adapter is 50 meters (164 feet). For connection to an external transceiver, an AUI connector is provided.

  The maximum length of thin coaxial cable between adapters or repeaters is 185 meters (607 feet). For thin cable, the adapter provides a BNC coaxial connector; this connector is cabled into the Ethernet network using a BNC T-connector.

For twisted-pair cable, the adapter provides an RJ-45 connector and supports the use of a Category 3, 4, or 5 shielded or unshielded twisted-pair cable with an RJ-45 connector on each end. The maximum length of twisted-pair cable between the IBM 2217 MpC and the concentrator is 100 meters (328 feet).

Full-duplex (20 Mbps) mode requires the RJ-45 connection and an Ethernet switch, such as the IBM 8271 EtherStreamer Switch. The Ethernet switch might require a crossover cable; see the documentation for the switch.

The part of the Ethernet ISA Adapter that can be seen in the slot contains two LEDs, one amber and one green. These LEDs provide information useful for monitoring the status of the adapter. If the amber LED is blinking, the adapter is receiving or transmitting data. If you are using twisted-pair cable (10Base-T) and the green LED is on, the adapter is receiving link pulses from an attached device.

- **X.21 WAC ISA Adapter (F/C 2905 and F/C 3905):** This feature is the X.21 version of the WAC Adapter. It contains the WAC common card, a 5-meter (16 ft 5 in.) cable, and an X.21 interface that requires an external CSU/DSU. Communication line speeds of up to 2.048 Mbps are supported.

  Use F/C 2905 to order the first or only WAC Adapter for this 2217. Use F/C 3905 to order the second WAC Adapter for this 2217.

- **X.21 WAC ISA EIB (F/C 2906):** This feature provides a CCITT X.21 WAC electrical interface that adds a second WAC interface port to the first X.21 WAC ISA Adapter. The total throughput of the adapter with the second interface installed is 2.112 Mbps. A 5-meter (16 ft 5 in.) cable and wrap plug are shipped with this feature.

- **V.35 WAC ISA Adapter (F/C 2915 and F/C 3915):** This feature is the V.35 version of the WAC Adapter. It contains the WAC common card, a 5-meter (16 ft 5 in.) cable, and a V.35 interface that requires an external CSU/DSU. Communication line speeds of up to 2.048 Mbps are supported.

- **V.35 WAC ISA EIB (F/C 2916):** This feature provides a CCITT V.35 WAC electrical interface that adds a second WAC interface port to the first V.35 WAC ISA Adapter. The total throughput of the adapter with the second interface installed is 2.112 Mbps. A 5-meter (16 ft 5 in.) cable and wrap plug are shipped with this feature.

- **EIA 422/449 WAC ISA Adapter (F/C 2925 and F/C 3925):** This feature is the EIA 422/449 version of the WAC Adapter. It contains the WAC common card, a 5-meter (16 ft 5 in.) cable, and an EIA 422/449 interface that requires an external CSU/DSU. Communication line speeds of up to 1.544 Mbps are supported.

  Use F/C 2925 to order the first or only WAC Adapter for this 2217. Use F/C 3925 to order the second WAC Adapter for this 2217.

- **EIA 422/449 WAC ISA EIB (F/C 2926):** This feature provides an EIA 422/449 WAC electrical interface that adds a second WAC interface port to the first EIA 422/449 WAC ISA Adapter. The total throughput of the adapter with the second interface installed is 2.112 Mbps. A 5-meter (16 ft 5 in.) cable and wrap plug are shipped with this feature.

- **EIA 232/V.24 WAC ISA Adapter (F/C 2928 and F/C 3928):** This feature is the EIA 232D/V.24 version of the WAC Adapter. It contains the WAC common card, a 5-meter (16 ft. 5 in) cable, and a wrap plug. Communication line speeds of up to 19.2 kbps are supported.

Use F/C 2928 to order the first or only WAC Adapter for this 2217. Use F/C 3928 to order the second WAC Adapter for this 2217.

- **EIA 232 WAC ISA EIB (F/C 2927):** This feature provides an EIA 232D/V.24 WAC electrical interface that adds a second WAC interface port to a WAC adapter (F/C 2905, 2915, 2925, or 2928). The EIA 232D/V.24 electrical interface as a second interface supports speeds of up to 19.2 kbps. A 5-meter (16 ft 5 in.) cable and wrap plug are shipped with this feature.
- **ISDN Basic Rate Interface Adapter (F/C 3930):** This feature provides an ISDN basic rate interface (2B and D). It is a high-speed communications adapter that supports two 64-kbps data channels and one 16-kbps control channel. Only one ISDN Basic Rate Interface Adapter can be installed in each 2217.

  It contains the adapter and a 3-meter (10-ft) cable. The ISDN Basic Rate Interface Adapter must be connected to a Network Termination 1 (NT1) unit. The NT1 terminates the ISDN network at the customer premises. The public ISDN network attaches to the U interface on the NT1; the ISDN Basic Rate Interface Adapter attaches to the S interface on the NT1.
- **Performance Package 1 (F/C 3000):** This feature consists of a 100-MHz 486DX4 processor card and 16 MB of RAM. It is available only on the Model 200.
- **Performance Package 2 (F/C 3001):** This feature consists of 16 MB of RAM and is available only on the Model 300.

Part 2. SNA Support

Chapter 2. SNA Enhancements

The SNA support provided by IBM 2217 Nways MpC Release 2.0 has been enhanced with several architectural upgrades. These enhancements and the support of the new High Performance Routing (HPR) provide a robust networking mechanism in IBM 2217 Nways MpC Release 2.0. In this chapter, we describe the architectural upgrades and describe a configuration scenario using IBM 2217 Nways MpC Release 2.0 nodes supporting the new HPR option.

2.1 CP-CP Session Reactivation

The purpose of an APPN node control point (CP) is to manage the local resources and to monitor and report on their status. APPN end nodes and network nodes may participate in a CP-CP session.

An end node may only establish a CP-CP session with a single network node, even if attached to multiple network nodes. The network node partner to the CP-CP session is referred to as its network node server. This CP-CP session between an end node and a network node server allows the following functions:

- The end nodes local resources (LUs) to be registered with the network node server
- The network node server to locate, or verify the location of, a local LU (LOCATE request)
- The end nodes locally attached transmission groups (TGs) to be reported to the network node server for LU-LU session route selection
- Network node route information to be reported to the end node LUs
- The end node management services exchange to report on the local resource status to the network node server, and subsequently possibly be forwarded to a non-adjacent focal point

CP-CP sessions may also be established between adjacent network nodes. This additionally enables the exchange of network topology and domain directory searches.

IBM 2217 Nways MpC Release 2.0 implements APPN function tower 1015 for both end nodes and network nodes. This attempts to maintain CP-CP sessions between an end node and a network node server and between adjacent network nodes. After a CP-CP session outage, if the sense code implies that the session is recoverable, then IBM 2217 Nways MpC Release 2.0 will attempt to reestablish its CP-CP contention winner session.

This functionality is also supported by:

- VTAM Version 4 Release 1 and higher
- AS/400 Version 2 Release 1 and higher
- Communications Server for OS/2 Warp Version 4.0 and higher

2.1.1 End Node CP-CP Reactivation

The session services component of the end node retains the following information exchanged with network nodes:

- CP capabilities, including CP-CP activation function (known as uplevel NN in logic flow). The CP capabilities flow in the GDS variable X'12C1' (see Figure 3).
- Sense code from the partner node when its CP-CP session was unbound with a retriable sense code.

An end node will attempt to bind to partner network nodes, after a CP-CP outage, in the following sequence:

1. Network nodes that unbound with a retriable sense code
2. Uplevel network nodes
3. Preferred network node server

If the end node fails to bind its contention winner CP-CP session, the sequence is repeated at 3 minute intervals.

2.1.2 Network Node CP-CP Reactivation

The session service component of a network node will attempt to reactivate its contention winner CP-CP sessions with all network nodes that have previously unbound with a sense code that allows it to retry. Reactivation of the CP-CP session is attempted at 3 minute intervals.

```
Line:   152 Send MU
Time stamp: 16:42:29.34
DLC type: IBMTRNET
Adapter number: 00
Destination address: 40005200521604
ALS ID: A40E8F7713608CA1
||TH: FID2, OIS, LFSID=0x10201, SNF=0x0001
||RH: RQ, FMD, OIC, RQE1, PI, CEBI
||CP capabilities
||   Last FRSN received = 0x00000000
||   Locate GDS variable = Supported
||   Directory services = Supported
||   Resource registration = Supported
||   Characteristics registration = Not supported
||   Topology resource descriptor = Supported
||   Topology database update = Supported
||   MS capabilities exchange = Supported
||   Bypass topology non-verify = Supported
||   Parallel CP sessions = Supported
||   CP-CP session activation enhancements = Supported
||   Extended border node = Not supported
```

Figure 3. CP Capabilities from an IBM 2217 Nways MpC Release 2.0 Network Node

2.1.3 Configuration

No specific configuration is necessary to implement CP-CP session reactivation. It should be noted that for an alternative network node server CP-CP session to be established, an active link must exist to this network node.

2.2 SSCP Takeover

SSCP takeover is a subarea functionality that enables non-disruptable session continuation on SSCP failure. Original APPN architecture made no consideration for the effects of SSCP takeover within a composite network node (CNN).

The composite network node functionality of VTAM and NCP has evolved from the requirement to integrate subarea SNA networks and APPN networks, and to facilitate the migration from subarea networks to APPN networks. The CNN provides pure APPN NN functionality to the APPN network and PU type 5 SSCP functionality to the subarea network. The CNN, consisting of one SSCP and at least one NCP, is viewed as a single T2.1 network node to adjacent APPN nodes and assumes the name of the owning SSCP. The CNN helps to locate resources in the heterogeneous networks by mapping an APPN type search request (LOCATE) to that of a subarea and vice versa. The boundary function (BF) enables LU dependent flow through APPN networks.

Subarea SSCP takeover occurs when an SSCP that owns subarea resources fails and another SSCP assumes the ownership of the resources, including the NCP BF. For the adjacent APPN network to maintain sessions to the CNN and subarea, the resulting CP name change and possible transmission group number change must be accommodated by APPN nodes.

Support for SSCP takeover of an NCP BF is possible with the following architecture updates:

- Nonactivation XID3 support. In the event of an SSCP takeover the NCP BF notifies the adjacent APPN nodes by nonactivation XID3.
- Transmission group (TG) number renegotiation with a nonactivation XID3. A CP name change within the nonactivation XID3 will cause the TG number renegotiation.
- Multiple CP names over a switched link. When the adjacent node is connected via a switched link to the CNN, the node will experience a CP name discrepancy between the configured CP name and that received within the XID3. This is viewed as CP name change support during the link activation phase instead of during a nonactivation phase.
- Secondary LS initiated nonactivation XID3 support. Enables a secondary link station (SLS) NCP BF to initiate a nonactivation XID3 to inform the adjacent node of the SSCP takeover. This situation may occur in the NRM such as SDLC link. The NCP BF, as an SLS, is not always allowed to initiate a nonactivation XID3.
- Transmission group quiesce support. The NCP BF sends a TG quiesced to indicate the TG is active, but temporarily out of service for new session initiation. This is used when the NCP BF loses the SSCP, and hence its ability to process and serve session initiation (bind) requests. The adjacent node will not send further bind requests while the TG is quiesced.

IBM 2217 Nways MpC Release 2.0 supports the nonactivation XID3 as a responder, enabling non-disruptive session continuation following an SSCP

outage and takeover. However, IBM 2217 Nways MpC Release 2.0 will not initiate the nonactivation XID3 to change the node or TG characteristics.

2.2.1 Configuration for SSCP Takeover

IBM 2217 Nways MpC Release 2.0 definition and support for SSCP takeover is dependent on the fully qualified adjacent CP name parameter.

To enable the SSCP takeover function in the IBM 2217 Nways MpC Release 2.0, do not specify the FQ adjacent CP name for links to an NCP boundary function node. Specifying this value causes the IBM 2217 Nways MpC Release 2.0 node to indicate to the adjacent CP that it does not support CP name change. Therefore, you must leave this name blank as shown in the following RCU configuration panel:

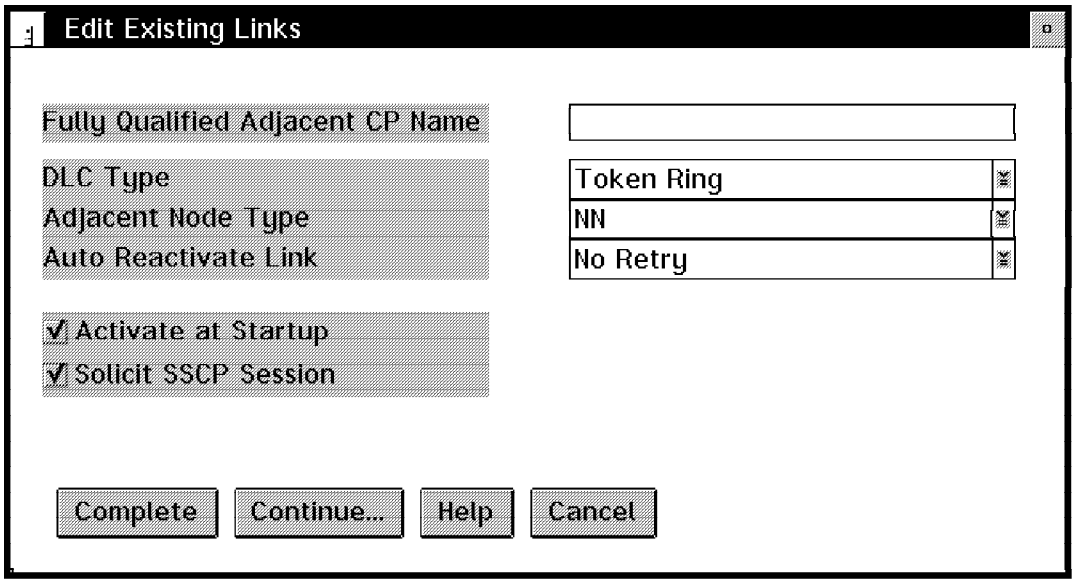


Figure 4. SSCP Takeover Sample Configuration

2.3 Network Topology Database

All network nodes within an APPN network maintain a network node topology database. This database contains information on the network node connections and is used during route selection for local LUs and LUs within end nodes that it serves. The integrity of this database is integral to the efficiency of the APPN network. Two areas will be considered:

- **Parallel TDU:** Parallel Topology Database Updates
- **Garbage Collection:** The deletion of out-of-date network topology information

2.3.1 Parallel Topology Database Updates

To maintain a consistent network topology database throughout the network, adjacent network nodes exchange topology database updates (TDUs) across the CP-CP session. A network node will send the full network topology to the adjacent node every five days. A network node will also send TDUs when the state of a local resource is updated (for example, when a network node or related transmission group is activated or deactivated, or their characteristics

change). The TDU is included in an FID2 RU (or FID5 RU for control flows over RTP), GDS variable X'12C2'.

To ensure the TDU is distributed efficiently to all attached network nodes, IBM 2217 Nways MpC Release 2.0 implements parallel TDU updates. An internal transaction program (architected TP) is started for each network node. This addresses two problems associated with serial TDU processing:

- Delayed distribution of the TDU. Updates to a congested node's database may cause delays to update other adjacent nodes.
- CP-CP session deactivation. Due to the queuing implemented for serial TDUs, a timeout deactivates the CP-CP session. This releases the internal TP to update further network nodes.

2.3.1.1 Configuration

No additional configuration is required for IBM 2217 MpC or adjacent nodes. The implementation of the parallel topology database updates is internal to IBM 2217 Nways MpC Release 2.0.

2.3.2 Garbage Collection

Garbage collection is a process to ensure the information within the local network topology database is current. A resource defined within the local network topology database will be discarded if no information is received within a 15 day period. To prevent the deletion of current information, a network node broadcasts TDUs for its local resources every 5 days. All network nodes receiving the TDUs will reset the resource time left field to 15 days.

Original TDU architecture did not include age information concerning the resources. This had the potential to result in topology databases with old and possible erroneous information, and thus databases that were larger than necessary.

Consider the scenario where a new network node joins a network. Adjacent network nodes will send TDUs containing the network topology database. No age information will be received and hence the resources will be assumed current and assigned a 15 day garbage collection timer. In Figure 5, when NN2 is introduced to the network, NN1 sends the network topology update. Information regarding NN4, due for deletion from NN1 in 1 day's time, is assigned the full 15 days by NN2. The age information within the network is now inconsistent. NN2 will retain information on NN4 longer than necessary.

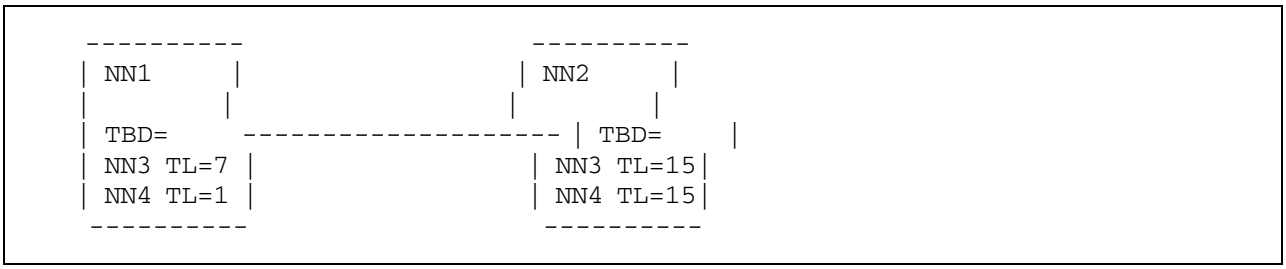


Figure 5. Network Topology Database Update, Old Architecture

To prevent the effects of persistent network topology entries, the architecture has been updated as follows:

- A new bit is defined within the node characteristics control vector (CV x'45') in the node type and status subfield (x'80') to indicate the resource is to be garbage collected. The bit is translated in the detailed formatted trace (see Figure 6 on page 24).
- A new control vector, topology resource descriptor (CV X'48'), is defined to include the time left field for garbage collection. The control vector is translated in the detailed formatted trace (see Figure 6).
- A new bit is defined within the TG characteristics control vector (CV x'47') to indicate the resource is to be garbage collected.
- A new bit is defined for the CP capabilities GDS variable X'12C1' to indicate the support for receipt of topology resource descriptor control vector. See Figure 7 on page 25 for the detailed formatted trace of the CP capabilities.

```
||Topology database update
||   Flow-Reduction Sequence Numbers TDU control vector
||    (0x0002) Current FRSN = 0x00000024
||    (0x0006) Last FRSN sent = 0x00000000
||   Node Descriptor TDU control vector
||    (0x0003) Network qualified CP name = USIBMRA.CP31741
||    (0x0013) CP name identifies a connection network = No
||   Node Characteristics TDU control vector
||     Node Type and Status subfield
||      (0x0002) Sequence number = 0x00000007
||      (0x0006) Route-addition resistance = 0x80
||      (0x0007) Node congested = No
||               Intermediate routing resources depleted = No
||               Endpoint resources depleted = No
||               Node will be garbage collected next cycle = No
||               Quiescing = No
||      (0x0008) Gateway services = Not supported
||               Central directory services = Supported
||               Intermediate routing services = Supported
||               Node type = Type 2.1
||      (0x0009) Peripheral border node = Not supported
||               Interchange node = Not supported
||               Extended border node = Not supported
||               HPR support level = Not supported
||   Topology Resource Descriptor control vector
||     Time Left Before Garbage Collection subfield
||      (0x0002) Days before garbage collection occurs = 15
```

Figure 6. Topology Database Update (TDU)

```
Line:   1760 Send MU
Time stamp: 13:56:50.00
DLC type: IBMTRNET
Adapter number: 00
Destination address: 40005200518404
ALS ID: 780CA763A79B44A9
||TH: FID2, OIS, LFSID=0x10201, SNF=0x0001
||RH: RQ, FMD, OIC, RQE1, PI, CEBI
||CP capabilities
||   Last FRSN received = 0x0000004d
||   Locate GDS variable = Supported
||   Directory services = Supported
||   Resource registration = Supported
||   Characteristics registration = Not supported
||   Topology resource descriptor = Supported
||   Topology database update = Supported
||   MS capabilities exchange = Supported
||   Bypass topology non-verify = Supported
||   Parallel CP sessions = Supported
||   CP-CP session activation enhancements = Supported
||   Extended border node = Not supported
```

Figure 7. CP Capabilities

The updated architecture provides the following functionality:

- TDUs will include the resource time left in days. The network node topology database of a new network node will reflect the time left from the adjacent network node database and will not assume 15 days.
- Network nodes will broadcast a TDU to indicate a resource is to be garbage collected. This will set the time left for the resource to 1 day and set the garbage collection bit within the network topology database. This will synchronize the resource deletion from all network nodes.

2.3.2.1 Configuration

No configuration of IBM 2217 MpC is necessary to implement the database integrity enhancements. The function is internal to the IBM 2217 Nways MpC Release 2.0 APPN network node support.

2.4 Transmission Priority

Transmission priority is an integral part of the class of service. Both APPN and subarea networks may utilize the transmission priority to prioritize data transmission across a transmission group. The implementation of transmission priority is particularly important on busy networks, where the likelihood of network congestion resulting in data queuing is high.

APPN architecture defines four transmission priorities:

Network The highest transmission priority used for session control data (for example, the bind). The priority level is used for CP-CP and SNASVCMG sessions, isolated pacing messages (IPMs) and isolated pacing responses (IPRs).

High High transmission priority used for sessions using the IBM-defined #INTER and #INTERSC classes of service (COS).

Medium Medium transmission priority used for session data using the IBM defined #CONNECT class of service. This is the default value for transmission priority (for example, for LU 2 sessions that do not specify a mode in the bind and thus do not have a COS).

Low Lowest transmission priority used for sessions using the IBM defined #BATCH or #BATCHSC COS. This is commonly used for file transfer.

2.4.1 Configuration

The selection of the class of service, and hence the transmission priority, used for a specific session differs for LU 6.2 and non-LU 6.2 sessions.

2.4.1.1 Non-LU 6.2 Transmission Priority

IBM 2217 MpC SNA Gateway upstream sessions may receive an extended bind from the host that includes the COS for the session.

The ACTLU response from the SNA gateway will indicate the extended bind support (see Figure 8). The extended bind from the host may include a COS/TPF control vector, referencing the required transmission priority.

If no COS/TPF control vector is included within the bind, the default transmission priority *medium* is used.

```
Line:    121 Send MU
Time stamp: 16:42:39.81
DLC type: IBMTRNET
Adapter number: 00
Destination address: 40005200522904
ALS ID: 04006F83B9688CA1
||TH: FID2, Exp, OIS, LFSID=0x00002, SNF=0x0000
||RH: +RSP, SC, FI, RQD1
||ACTLU +rsp
||   Activation type = Cold
||   FM profile = 0
||   TS profile = 1
||   SSCP-LU session capabilities control vector:
||    (0x0001) Maximum RU size = No limit
||    (0x0002) Unsolicited character-coded requests = Not supported
||             Unsolicited field-formatted requests = Not supported
||   LU-LU session services capabilities control vector:
||    (0x0002) PLU capability = Inhibited
||             SLU capability = Disabled
||    (0x0003) LU-LU session limit = 256
||    (0x0005) LU-LU session count = 0
||    (0x0007) SESSST capability = Suppressed if SLU
||             XRF session activation CV supported on BIND = No
||             Peripheral node extended BIND receive support = Yes
||             Network-qualified name receive support = No
||             Subarea node extended BIND support = Yes
```

Figure 8. ACTLU Response, Including the Extended Bind Control Vector

2.4.1.2 LU 6.2 Transmission Priority

An LU 6.2 transaction program uses the ALLOCATE verb to request a specific mode for a session. The mode definition will include the class of service and thus the transmission priority. See Table 3 for details on the IBM defined modes and classes of service. New modes and new classes of service may be defined to include a required transmission priority.

The following modes are shown:

- CPSVCMG. This mode is used by the internal APPN CP-CP sessions. You cannot change this mode and its class of service will always indicate network priority.
- CPSVRMGR. This mode is used by the DLUR pipe. The DLUR pipe is a pair of LU 6.2 sessions where the SSCP-PU and SSCP-LU sessions will be encapsulated.
- SNASVCMG. This mode is used by the internal APPC sessions. You cannot change this mode and its class of service will always indicate network priority.
- Other modes. They are normally used by applications and their class of service may be selected for high, medium or low priority.

Table 3. IBM Defined Modes and Classes of Service

Mode Name	**COS Name**	**Transmission Priority**
CPSVCMG	CPSVCMG	Network
CPSVRMGR	SNASVCMG	Network
SNASVCMG	SNASVCMG	Network
blank	#CONNECT	Medium
#BATCH	#BATCH	Low
#BATCHC	#BATCH	Low
#BATCHCS	#BATCHSC	Low
#BATCHSC	#BATCHSC	Low
#INTER	#INTER	High
#INTERC	#INTER	High
#INTERCS	#INTERSC	High
#INTERSC	#INTERSC	High

2.5 High Performance Routing (HPR)

The increase in reliability of the physical network connection since the original design of APPN has reduced the requirement for excessive software error checking. APPN HPR (High Performance Routing) is an APPN enhancement that utilizes the more efficient networks and updated connection and routing protocols to increase the performance for data routing and reliability.

HPR interoperates and maintains functional equivalence with current APPN to facilitate network migration to HPR.

IBM 2217 Nways MpC Release 2.0 supports HPR functions over:

- Token-ring
- Ethernet
- Frame relay

Note

IBM 2217 Nways MpC Release 2.0 *does not* support HPR over SDLC and X.25 links.

IBM 2217 Nways MpC Release 2.0 HPR implements the following functions to provide high-speed data transfer:

Rapid Transport Protocol (RTP) HPR establishes an RTP transport connection between the origin and destination nodes. Intermediate nodes are not aware of the sessions. RTP operates in the nodes that initiate and terminate the HPR connection (see Figure 9 on page 29). RTP provides the following functionality:

- Non-disruptive rerouting around network outages
- Efficient selective retransmission
- End-to-end data integrity and congestion control

Automatic Network Routing (ANR) ANR is a low-level source routing mechanism that minimizes processing cycles and storage necessary for routing packets. No intermediate node storage is required to maintain routing tables. All the routing information is stored within the header.

Adaptive Rate-Based (ARB) Flow and Congestion Control ARB flow control adapts the rate at which the sender transmits data into the network based on the receiver's ability to receive and process data. This algorithm is proactive and not reactive to the link state. This promotes high link utilization and prevents network congestion.

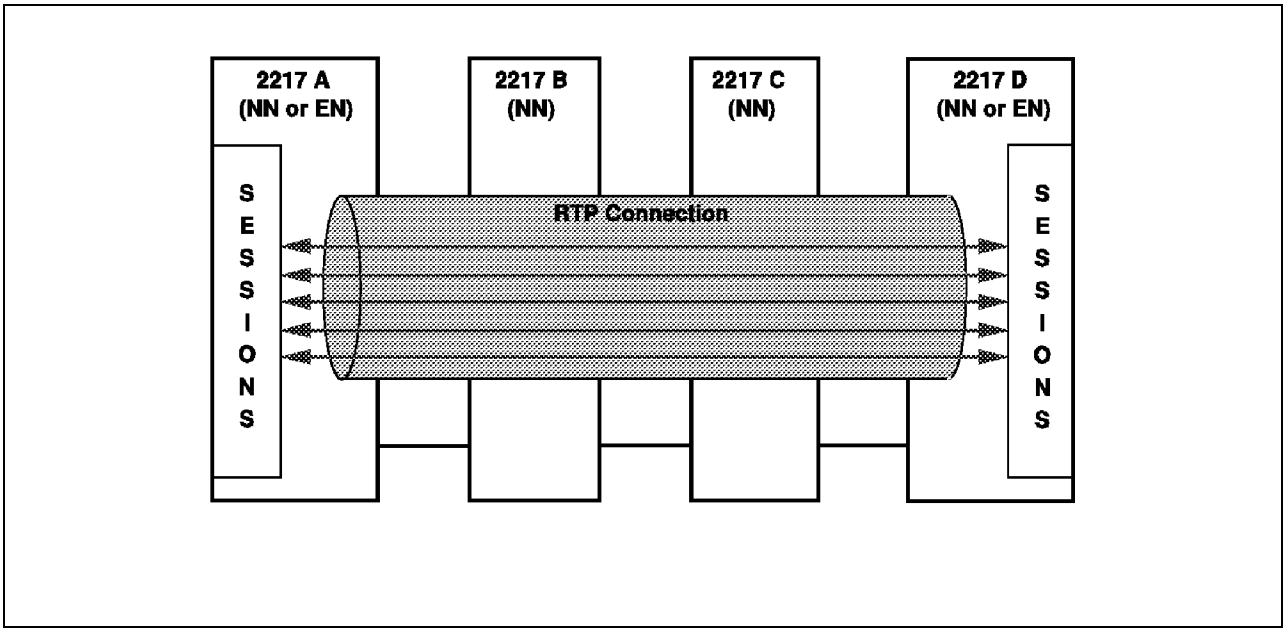


Figure 9. HPR RTP Connections in IBM 2217 MpC (NN or EN)

2.5.1 HPR Option Towers

The functionality provided by an HPR node contains a number of options, as with standard APPN nodes. The options, relevant to end nodes, have dependence due to the base functionality inherent to an end node (see Figure 10).

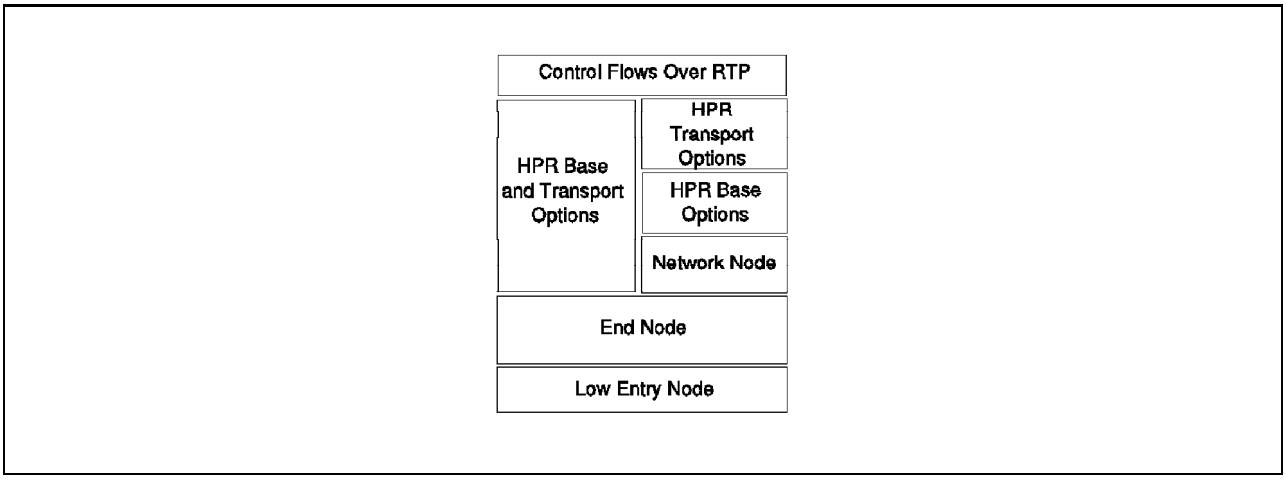


Figure 10. APPN and HPR Option Towers

HPR Base Node Option The primary function of an HPR base node is to provide ANR routing. Products solely implementing the base functionality can act purely as intermediate nodes within an HPR network. Hence, an end node cannot utilize the base options in isolation. See NNB in Figure 9 for the protocol layers active in an intermediate node. The HPR base functions are as follows:

- Support for ANR.
- FID2 routing for CP-CP sessions and LU-LU sessions. All CP-CP session traffic and LU-LU session traffic not defined over an RTP connection use standard APPN FID2 PIUs.

- Ability to route FID2 and ANR over one link.
- Create and translate TDUs indicating the level of HPR support.
- FID2 route setup. This capability is required for the initialization of the RTP connection. The intermediate nodes add the appropriate ANR information for inbound and outbound links to the FID2 during the route setup.
- Minimum link size of 768 bytes.
- HPR capability within the XID3 exchange. A new control vector within the XID3 details the level of HPR functionality supported by the node.
- Calculate HPR-only routes.

HPR Transport Option The primary function of the transport tower is to enable the establishment of an RTP connection. The RTP connection can only be established between two nodes that support this HPR options tower. Functionality provided includes the following:

- RTP and all its functions.
- Nondisruptive path switching. The reliability of HPR is dependent on its ability to reroute traffic around network outages. This is implemented by switching traffic to a different RTP connection when problems are detected.
- Directory reply with LU's NCE.
- APPN/HPR boundary function. This provides the function for routing pure APPN traffic across an APPN HPR network. The inbound FID2 PIU (APPN) is mapped to FID5 HPR traffic and vice versa.

Control Flows over RTP Option This option enables CP-CP sessions across RTP links. When the link is activated between two nodes supporting this option, a long-lived RTP connection is established. This RTP connection is used for route setup messages.

Note

IBM 2217 Nways MpC Release 2.0 *does not* support the control flows over RTP option. Therefore, APPN CP-CP sessions are not implemented over RTP connections.

As an end node does not support routing, the minimum requirement for an end node is to support both base and transport options. This enables an RTP connection to be established to or from the end node.

Figure 11 on page 31 illustrates the protocol stack in HPR nodes supporting border node capabilities (NNA and NNC) and NNB supporting pure HPR routing (ANR).

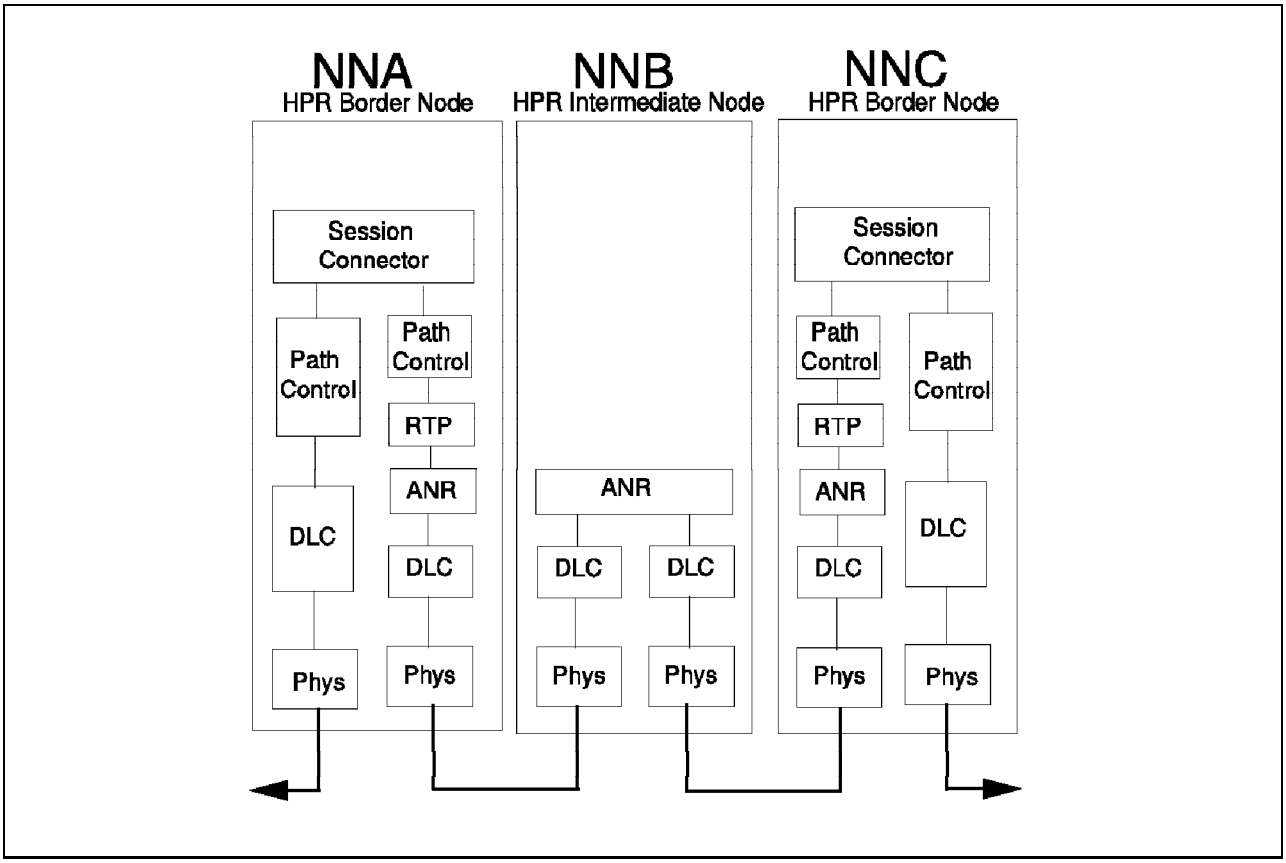


Figure 11. Protocol Stack for APPN/ISR and APPN/HPR Routing

2.5.2 HPR Format Overview

HPR flows between adjacent HPR nodes may contain XID3 I-frame, FID2 PIU or Network Layer Packets (NLP).

XID3 Packet As defined for base APPN with the addition of a new control vector. CV61 contains HPR specific information.

FID2 PIUs Utilized for the route setup protocol flow, CP-CP flow and LU-LU session traffic.

Network Layer Packet The RTP Network Layer Packet consists of the following:

- Network Layer Header (NHDR). See 2.5.4.1, “Network Layer Header” on page 39.
- Transport Layer Header (THDR). See 2.5.3.3, “RTP Transport Layer Header (THDR)” on page 35.
- Data.

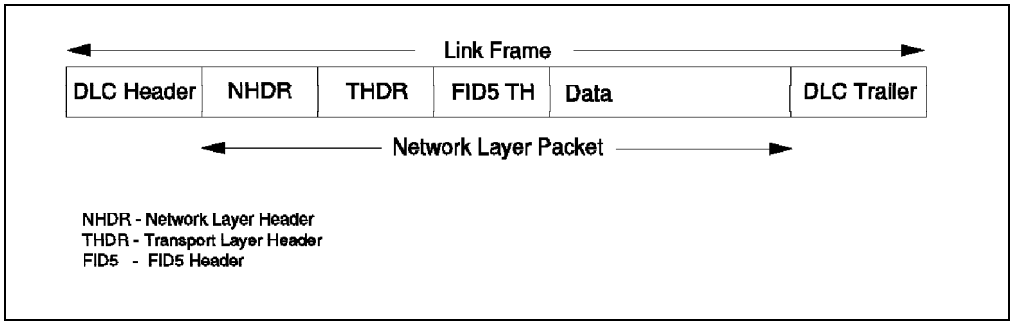


Figure 12. An HPR Frame Format

2.5.3 Rapid Transport Protocol (RTP)

RTP provides an end-to-end full-duplex connection to transport LU-LU and optionally CP-CP session traffic. An RTP connection provides:

- Reliability
- In-order delivery
- Adaptive rate-based flow/congestion control.

End-to-end connectivity eliminates the requirement for these functions within intermediate routing nodes.

An RTP connection can by utilized by multiple sessions with the same class of service (COS). The physical path of the RTP connection is dependent on the COS associated with the session. However, two partner nodes can share multiple RTP connections with the same COS over discrete physical paths to enable the balanced distribution of traffic over the network.

RTP traffic implements the new FID5 transmission header. This is similar to the base APPN FID2 transmission header, but a session address substitutes for the ODAI, OAF' and DAF' fields (see Figure 13 on page 33 for details).

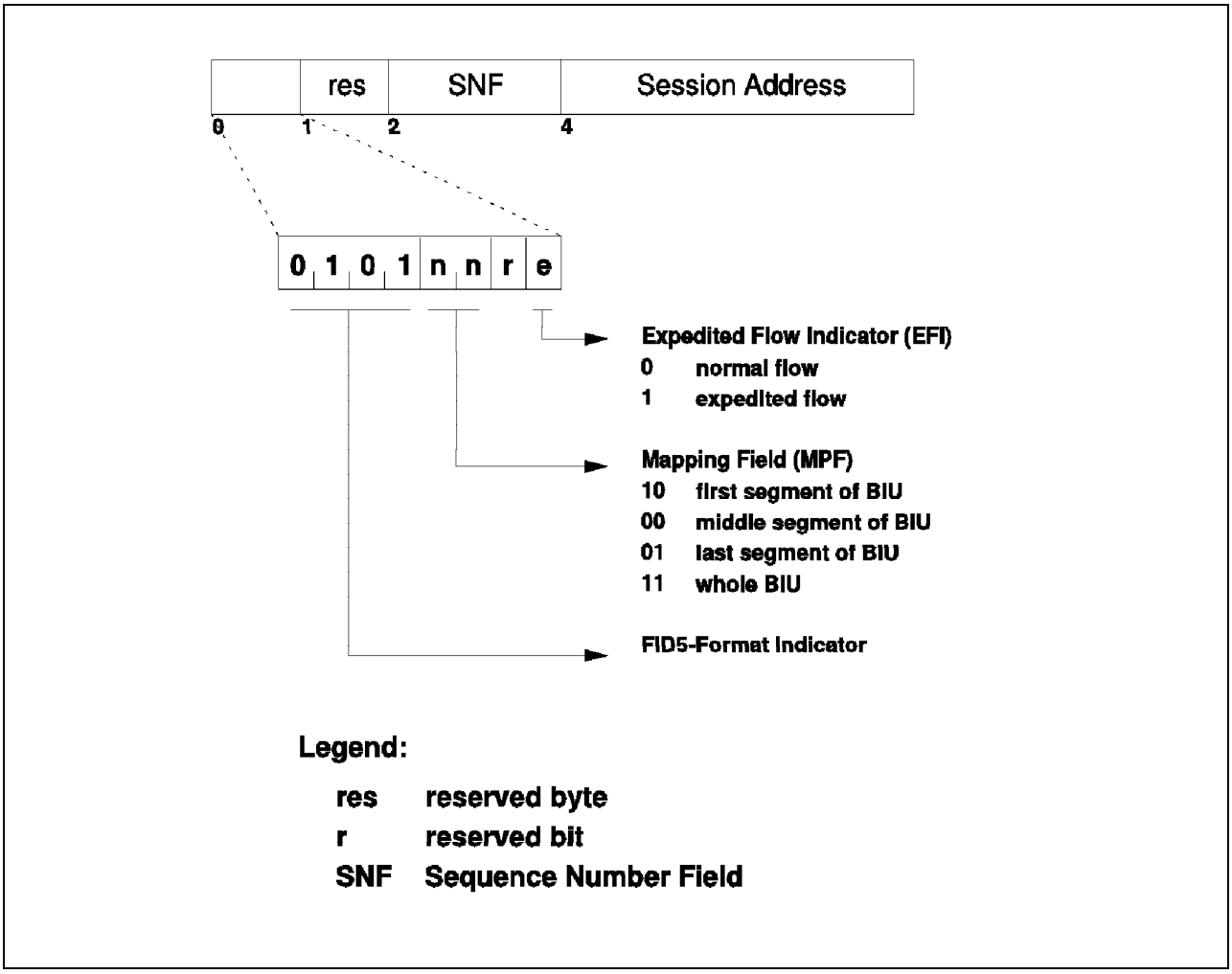


Figure 13. FID5 Format

A specific RTP connection is defined by the Route Setup Protocol request and reply. However, details regarding link HPR capabilities are passed during the XID3 flows and also by the APPN LOCATE. See Figure 14 on page 34 for the basic flow to establish RTP connection between two nodes.

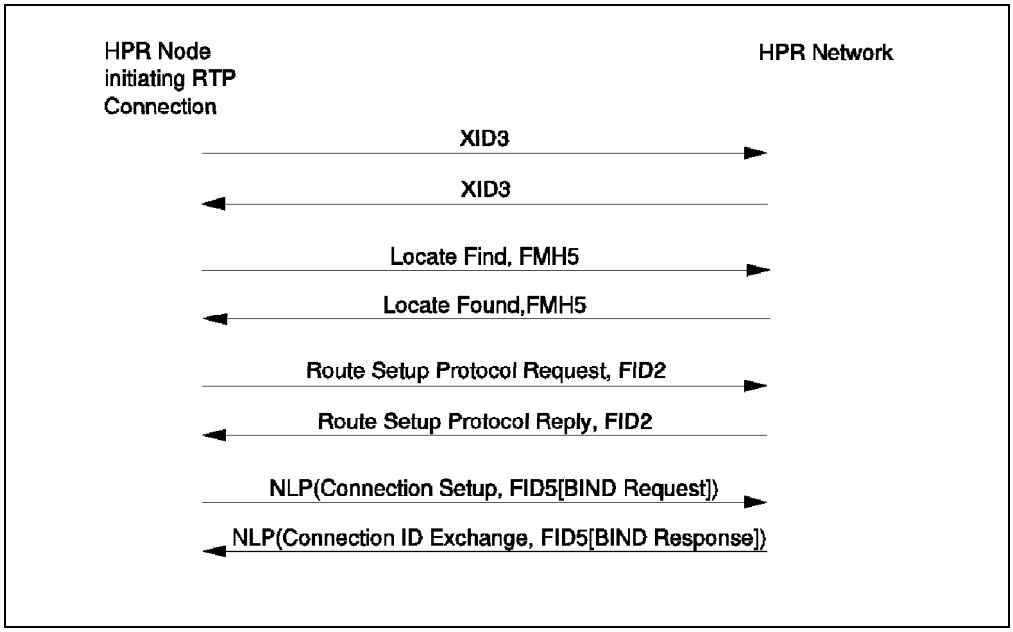


Figure 14. Basic Flow for RTP Setup

2.5.3.1 Network Connection Endpoint (NCE)

An RTP connection is defined between network connection endpoints (NCEs). A unique NCE identifier is defined for each node and is the last label within the ANR routing field. The NCE may define the following:

1. Control point NCE. This is solely for CP-CP RTP sessions supported by the HPR option control flows over RTP.
2. Logical unit NCE. This defines an LU that is located within a node that supports the HPR transport option.
3. Boundary function NCE. This defines a component within a node that translates between base APPN and HPR protocols.

2.5.3.2 Route Setup Protocol

The route setup protocol is initiated to establish an RTP connection between partner nodes. The route setup request and reply is updated by each intermediate node involved with the connection. Information gathered from each node includes the following:

- ANR label for next hop for outbound traffic
- ANR label for next hop for inbound traffic
- Maximum packet size for the outbound link
- Maximum packet size for the inbound link

The route setup reply confirms that the physical path and intermediate nodes are active and provides the necessary details for the originating node to establish an RTP connection.

The route setup is sent within a FID2 transmission header unless all nodes within the selected route support the HPR option control flows over RTP. The control flows over RTP option enables an RTP link to be utilized, and hence the route setup is passed with a FID5 transmission header.

2.5.3.3 RTP Transport Layer Header (THDR)

The RTP Transport Layer Header contains information necessary for the creation and control of an RTP connection in an HPR network. Optional segments carry information on the state of the connection (see Figure 15 for details).

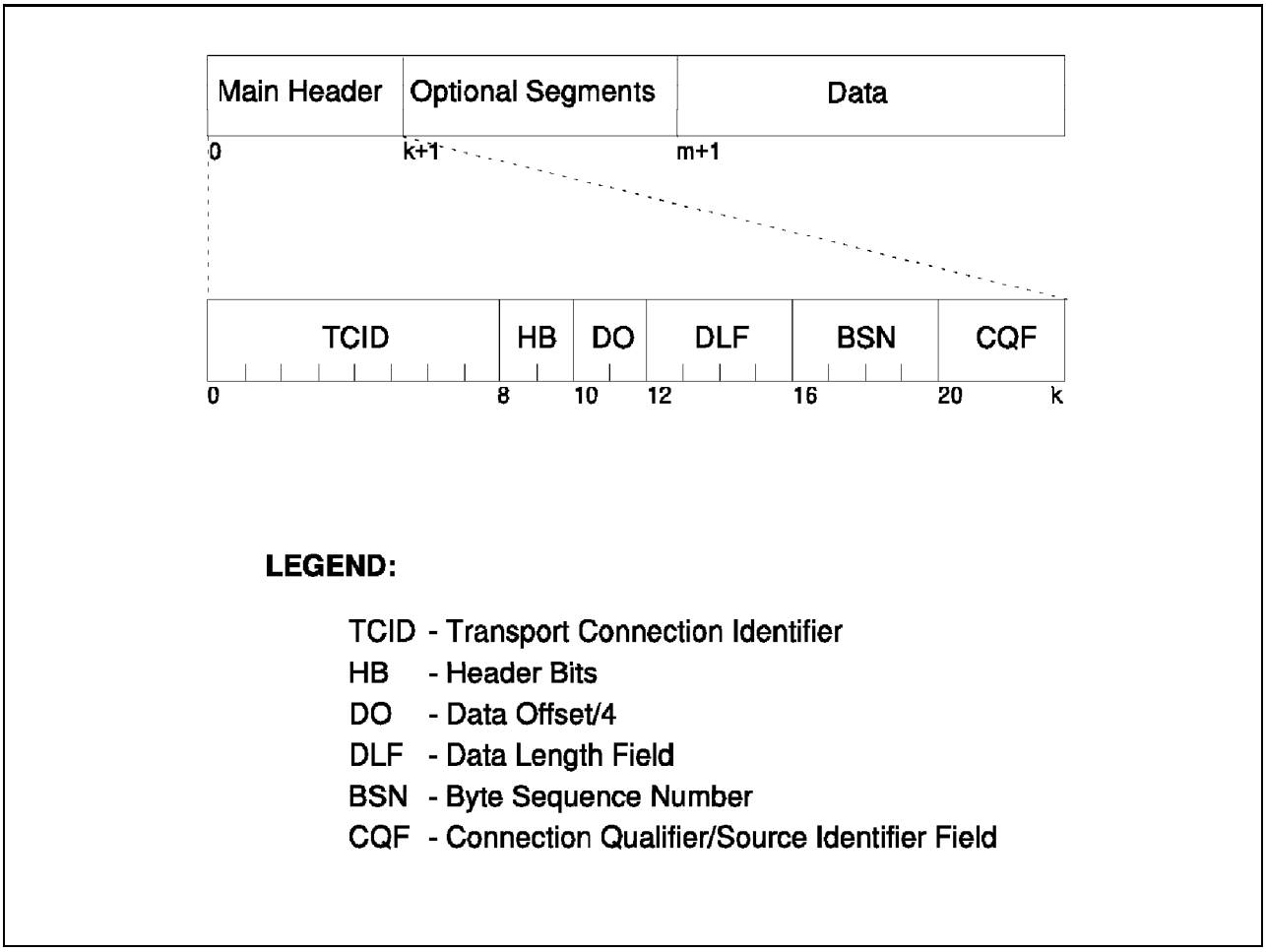


Figure 15. Transport Layer Header

Bytes 0-7 Transport Connection Identifier (TCID). Combined with the connection qualifier and the source identifier field, this uniquely defines a transport connection.

Bytes 8-9 Header Bits. These specify the characteristics and purpose of the RTP packet.

Bytes 10-11 Data offset/4. This is the position of the user data relative to the RTP header.

Bytes 12-15 Data length field. This is the exact number of user bytes within the user data field.

Bytes 16-19 Byte Sequence Number. This is the sequence number of the first byte within the user data carried by this packet.

Bytes 20-(20+k-1) Connection Qualifier/Source Identifier.

Bytes (20+k)-(20+k+m) Optional Segments. This is the control and management information.

2.5.3.4 Adaptive Rate-Based Flow/Congestion Control (ARB)

Adaptive Rate-Based Flow/Congestion Control implements a proactive algorithm to efficiently manage HPR data flow for maximum throughput with minimum congestion. ARB functions end-to-end for RTP connections.

The sender component of an RTP endpoint requests information regarding the state of the network and the remote RTP endpoint receiver. The sender utilizes this information to regulate the traffic input to the RTP connection. Note the RTP connection is full-duplex, and so the sender and receiver components exist at both endpoints of an RTP connection.

A dedicated optional segment within the Transport Layer Header carries the ARB information (see Figure 16).

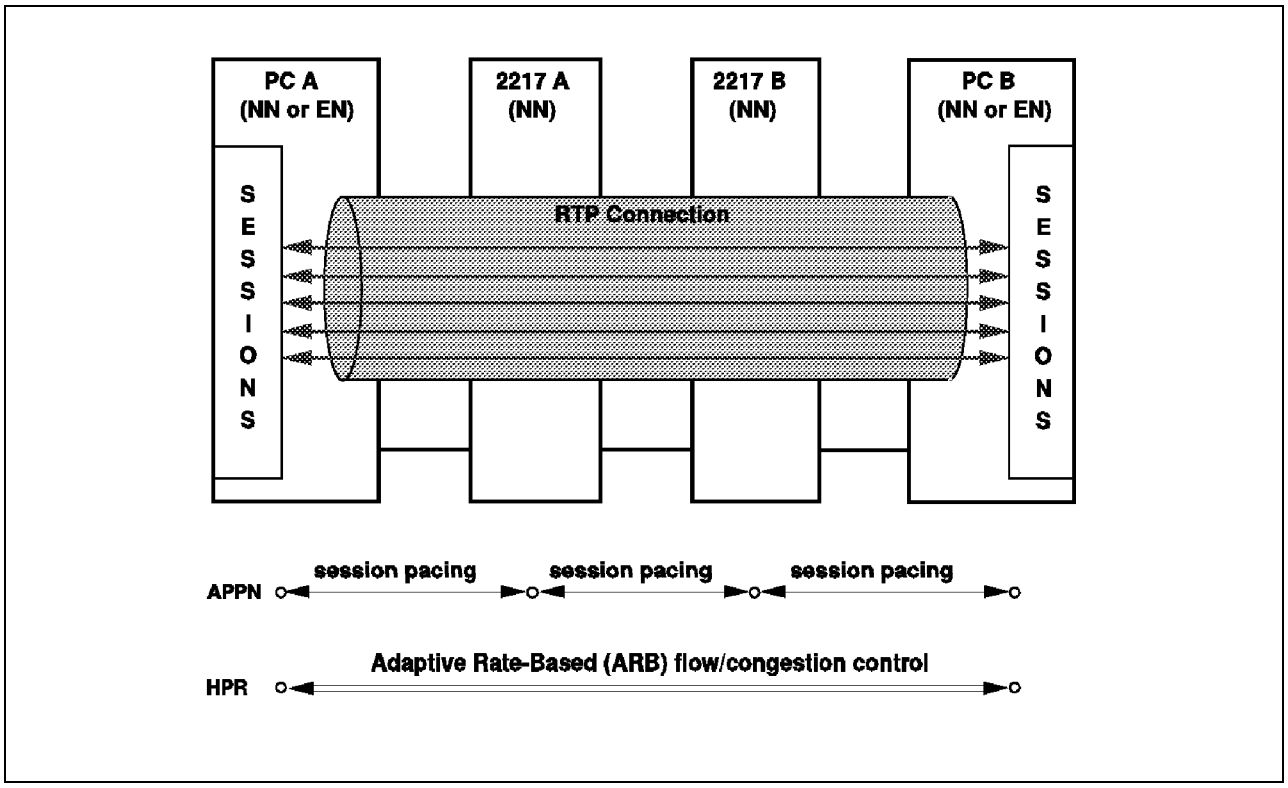


Figure 16. Comparison of Session Level Pacing and Adaptive Rate-Based Flow/Congestion Control

2.5.3.5 Alive Timer and Retry Count

The RTP alive timer and retry count are used to verify the RTP endpoints and that the path between the RTP endpoints are active. It also functions to maintain limited resource links during a period of session inactivity.

If there is no RTP traffic for the period of the alive timer, then a status request is sent and the SHORT_REQ timer is started. The timer is stopped if a status segment is received from the partner. If no status segment is received and the SHORT_REQ timer expires, then the status request is resent. A new RTP path is sought once the retry count has been reached. The RTP connection will be terminated if no alternative path is available or the remote node is not operational.

2.5.3.6 Segmenting

HPR data segmenting and reassembly is implemented end-to-end by RTP and is not a function of intermediate nodes. The RTP originator will select the maximum BTU size that does not exceed the limit of any intermediate links. This eliminates the requirement for intermediate segmentation. Information on the maximum BTU size supported by each intermediate link is supplied within the route setup protocol reply. The minimum packet size permissible for an HPR link is 768 bytes.

2.5.3.7 Error Recovery and Sequencing

Error recovery is implemented end-to-end on the RTP connection, and not over each link as with the base APPN. The RTP endpoint checks the integrity of the data and sequences the packets correctly. Erroneous packets are selectively retransmitted, on request from the RTP endpoint. Intermediate nodes in an RTP connection do not implement any data checks or sequencing.

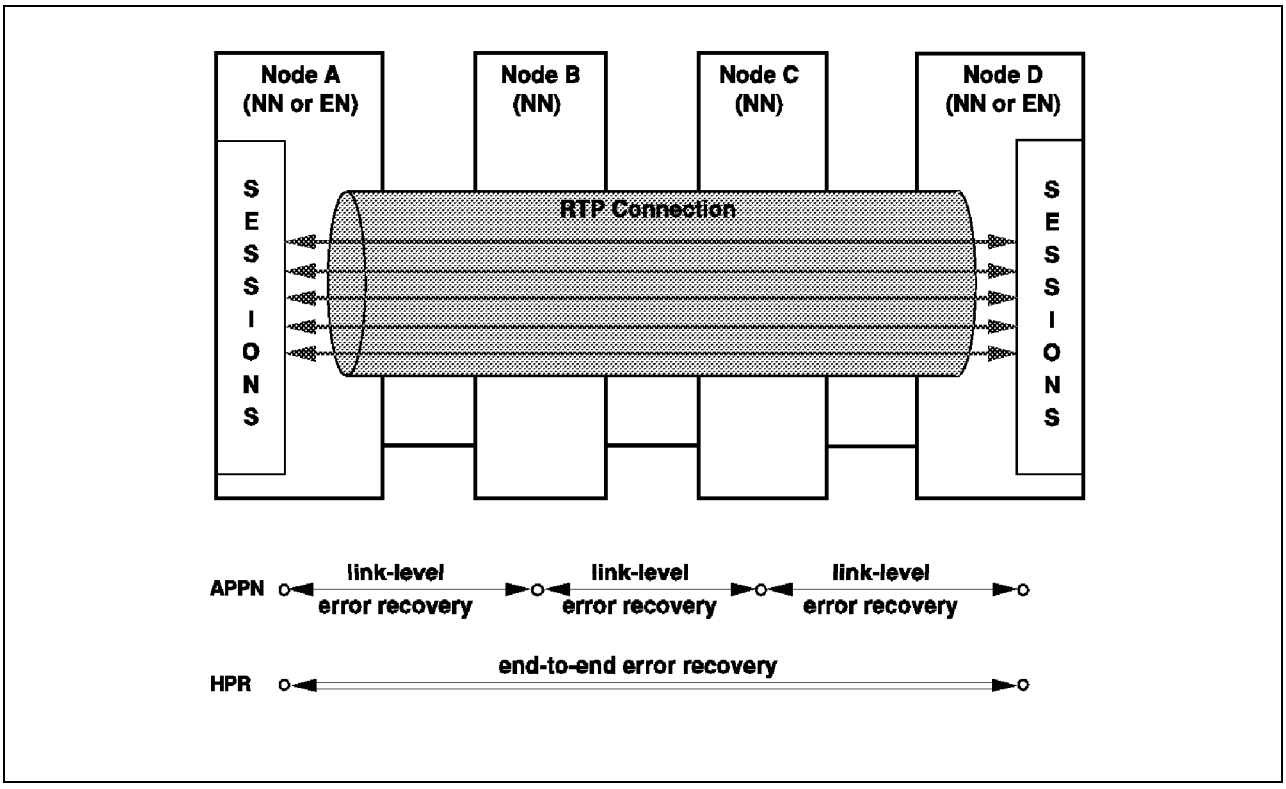


Figure 17. APPN/ISR versus APPN/HPR Error Recovery

2.5.3.8 Non-Disruptive Path Switch

The HPR path switch automatically reroutes traffic around a failed link or node. When a failure is detected, if an alternative path which satisfies the COS exists, a new RSCV is dynamically defined, the route setup protocol is used to define the HPR routing information and the RTP connection is activated. The existing sessions will not be disrupted by the rerouting. If an RTP connection of equivalent COS is already active, then this will be utilized for the path switch.

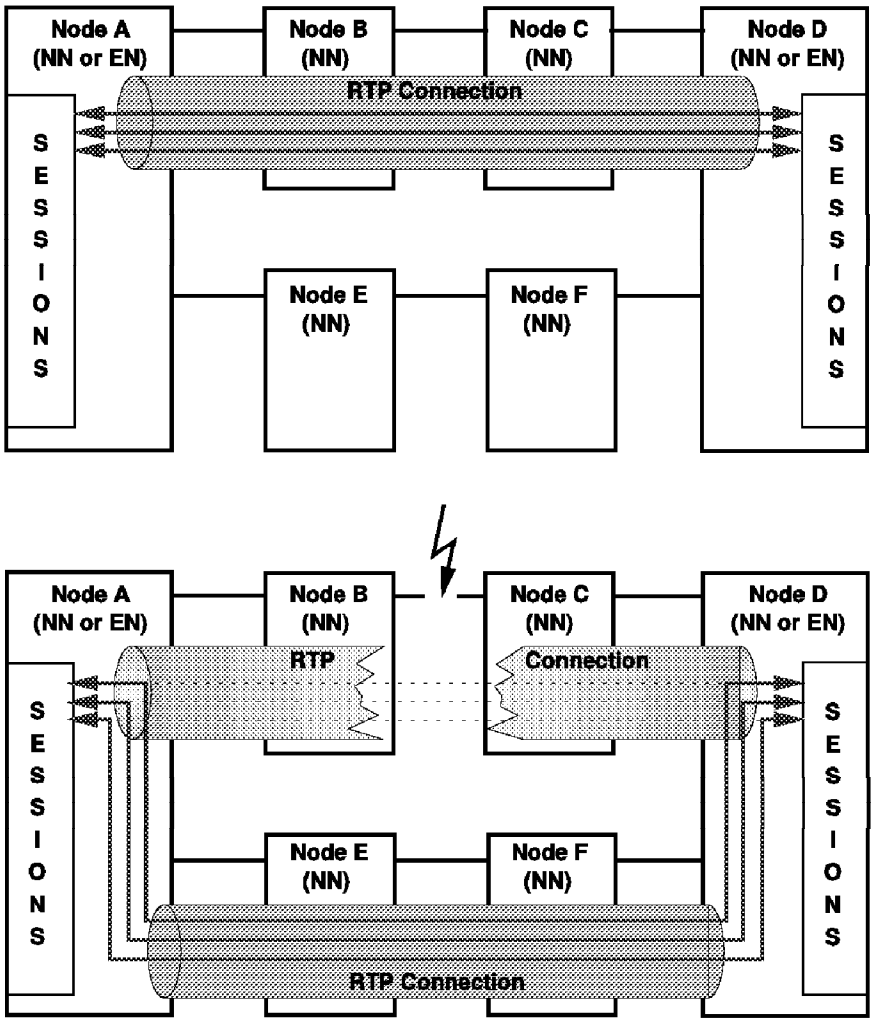


Figure 18. HPR Non-Disruptive Path Switch Around a Failed Link

2.5.4 Automatic Network Routing

Automatic network routing is a source routing protocol. The originating node defines the required packet routing information within the network layer header and thus intermediate nodes have minimal processing to reroute the packet.

2.5.4.1 Network Layer Header

The network layer header contains all the routing information required by the intermediate ANR nodes to forward the network layer packet to the remote RTP endpoint. The network layer header is of variable length.

Byte 0 Includes Transmission Priority Field
Byte 1 Reserved
Bytes 2 to M-1 ANR Labels - Routing labels used and discarded by the intermediate nodes
Byte M X'FF' - Indicates end of the ANR labels
Byte M+1 Reserved

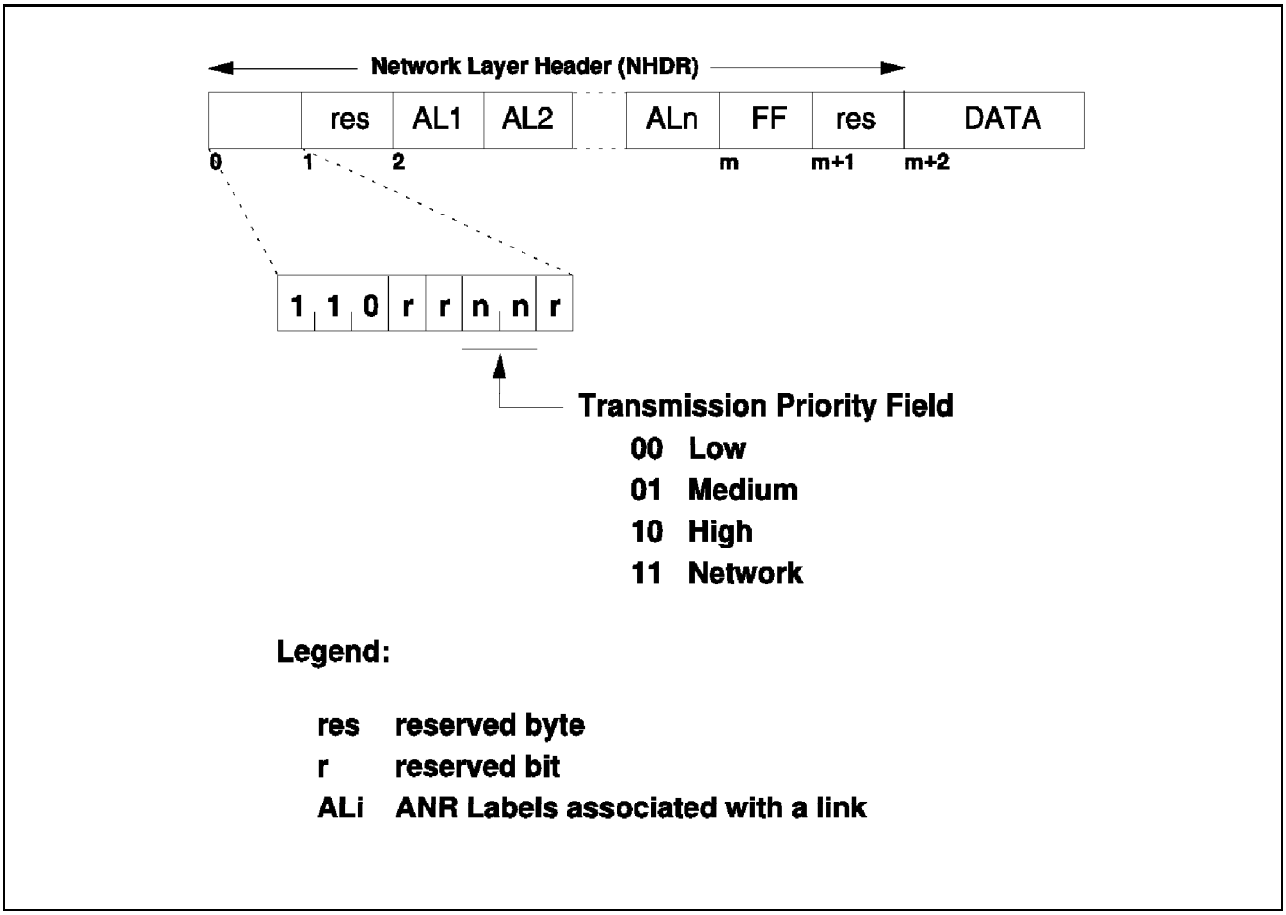


Figure 19. Network Layer Header (NHDR)

2.5.4.2 ANR Labels

ANR labels are used for routing the network layer packets through the network. A node will define a unique ANR label to each outbound link. That label will only have significance within the node, and the ANR routing field includes a series of ANR labels describing the entire route through the network.

Intermediate nodes will read the next ANR label in the series. This ANR label is discarded prior to routing the NLP over the referenced link. The RTP end node will route internally to the NCE.

2.5.5 HPR Support

HPR functionality is presently supported by the following products:

- VTAM Version 4 Release 3 (HPR base and transport options supported)
- OS/400 Version 3 Release 1 (HPR base options only)
- Communications Server Version 4.0 (HPR base and transport options supported)
- IBM 2217 Nways MpC Release 2.0 (HPR base and transport options supported)

2.5.6 IBM 2217 Nways MpC Release 2.0 HPR Configuration

The configuration for HPR support in an IBM 2217 MpC node differs depending on the partner establishing the HPR link.

Outbound Link activation The SNA link definition must include HPR support.

Inbound Link activation HPR support is always enabled for implicit links. This is common for network nodes, as the link is only explicitly defined within the end node configuration.

2.5.7 Additional HPR Parameters

Additional HPR parameters cannot be updated via the RCU configuration interface.

Note

The following HPR parameters are predefined in the IBM 2217 Nways MpC Release 2.0 and they cannot be changed using the configuration panels.

Alive Timer The time of inactivity on an RTP connection before a status request is sent to the remote RTP endpoint. This parameter is set to the value of 60 seconds.

Retry Count The number of status requests sent before path switch is initiated by the IBM 2217 MpC. This parameter is set to the value of 6.

Path Switch The period of time an RTP endpoint will attempt to establish an alternative path to a remote endpoint after a path failure. Depending on the class of service (COS) used in the session mode, the IBM 2217 Nways MpC Release 2.0 sets the following three path switch parameters:

- PATH_SWITCH_HIGH_TIMER = 120 seconds
- PATH_SWITCH_MEDIUM_TIMER = 240 seconds
- PATH_SWITCH_LOW_TIMER = 480 seconds

2.6 Sample Scenario

In this section, we show you a sample configuration of a network using IBM 2217 Nways MpC Release 2.0. Three IBM 2217 MpC machines are connected via frame relay (WAN) using modem eliminators. For LAN connectivity, T/R and Ethernet adapters are used. A PC is also connected to each 2217 in order to run the Remote Control Utility (RCU) as well as APPC/CPI-C applications in order to test the configuration.

The following values are used in this configuration:

- Network ID = USIBMSC.
- CP name (2217s) = x2217 (where x = A, B, C).
- CP name (PCs) = CPPCx (where x = A, B, C).
- All three 2217s are defined as network nodes using HPR over frame relay.
- Downstream (LAN) links will not be defined. Therefore, 2217s will take implicit links and will use HPR if supported by the connected PCs and VTAM.
- Links between 2217 NNs will be explicitly defined (required).
- APING application will be executed from any PC to any other node in the network including the 2217s and VTAM.

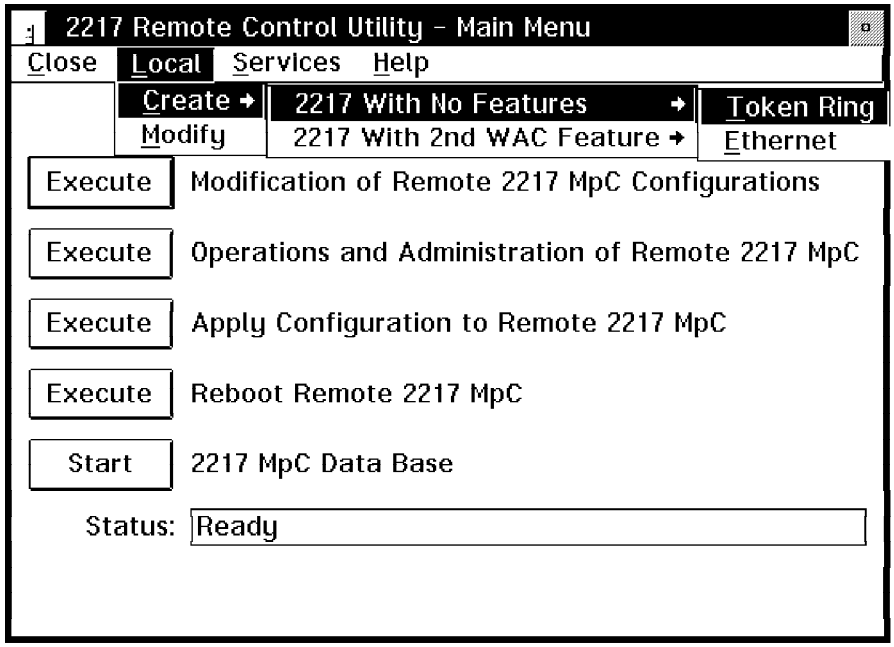


Figure 20. Using the RCU to Configure HPR over Frame Relay

2.6.1 RCU Configuration (2217-A)

In this section, we show you the RCU configuration options required to properly configure 2217-A for this scenario. The configuration is similar for 2217-B and 2217-C.

In order to configure the 2217-A, the following definitions are required:

1. LAN Adapter Configuration (T/R)
2. WAN Adapter Configuration to 2217-B (frame relay - WAC 1-0)
3. WAN Adapter Configuration to 2217-C (frame relay - WAC 1-1)
4. SNA local node characteristics
5. SNA link definitions to network nodes 2217-A and 2217-B

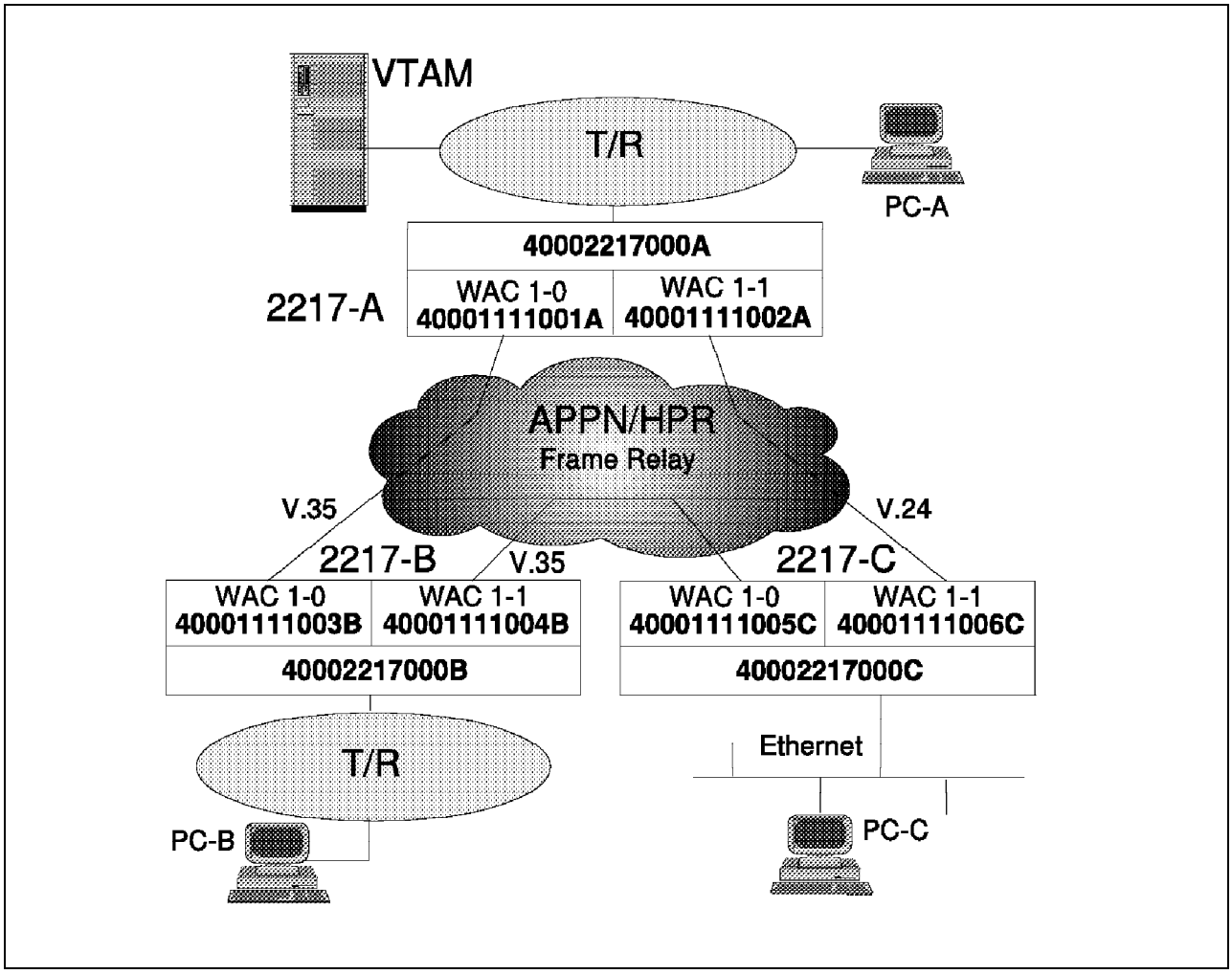


Figure 21. Scenario for HPR over Frame Relay

2.6.1.1 LAN Adapter (T/R)

In this panel, you enter the T/R address for the LAN adapter in 2217-A. Normally, default values are used for the IBM IEEE 802.2 and data link control (DLC) profiles. However, in some cases, you may need to browse the default values provided by the configuration utility and verify that these values satisfy your installation requirements (for example, the number of supported link stations).

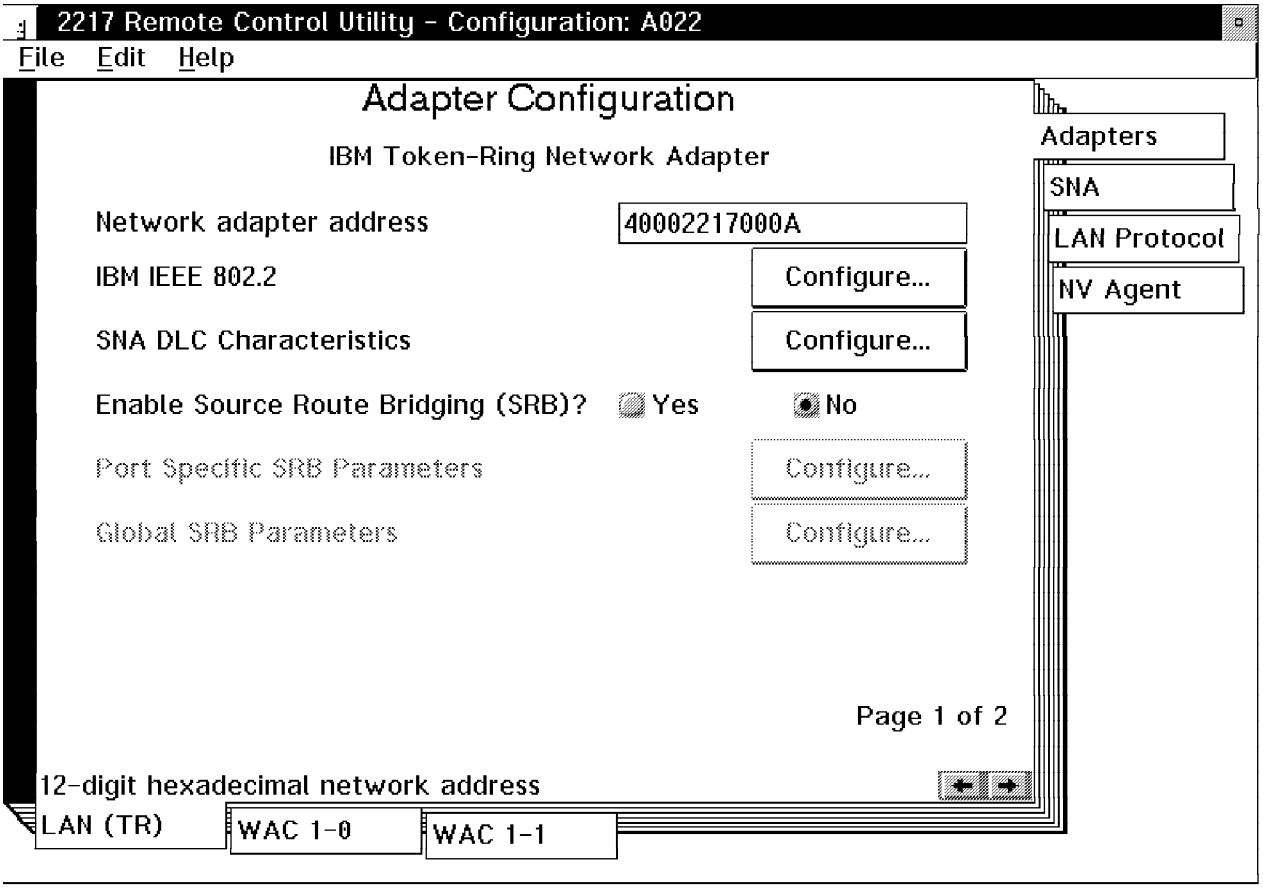


Figure 22. Token Ring Adapter Definition Panel

- **Network adapter address:** This is where the address of the token-ring adapter card is defined. For this configuration, the T/R address is 40002217000A.
- **IBM IEEE 802.2:** Default values are used for this profile.
- **SNA DLC Characteristics:** Default values are used for this profile.
- **Enable Source Route Bridging (SRB)?:** Not required in this configuration.

2.6.1.2 WAN Adapter Configuration to 2217-B (Frame Relay)

The IBM WAC 1-0 is selected for the connection to 2217-B. Frame relay is the WAN protocol; it is defined in the following panel:

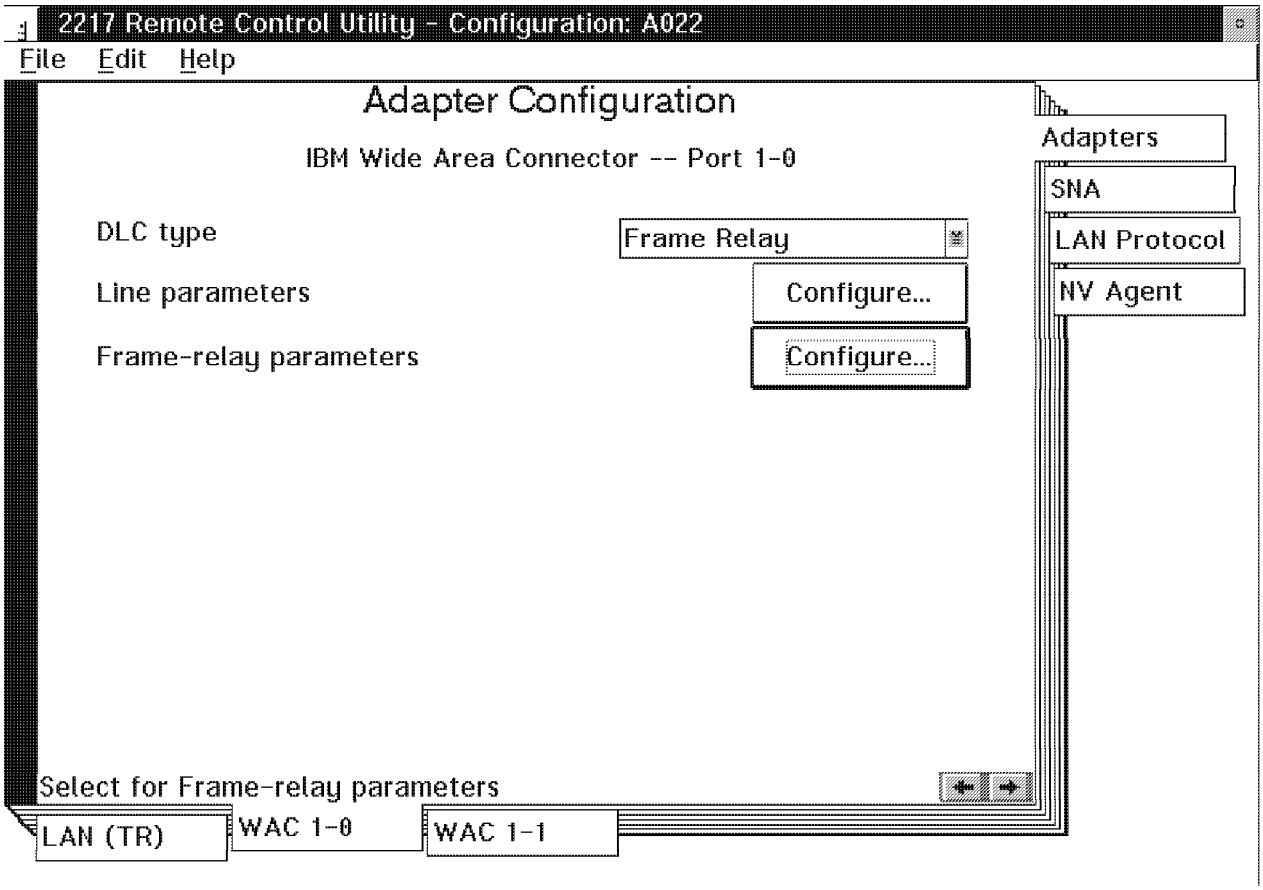


Figure 23. Link to 2217-B - WAC 1-0

- **DLC type:** This field specifies the type of data link control used by this port. The default is Not Configured and means that this port will not be used. The other options, SDLC/X.25 and Frame Relay will be displayed if you click on the arrow on the right side of the box. **Frame Relay DLC** is selected in this configuration.
- **Line parameters:** Select to configure line parameters.
- **Frame Relay parameters:** Select to configure frame relay parameters.

2.6.1.3 Line Parameters - WAC 1-0

In this panel, you define the line parameters for the frame relay connection to 2217-B.

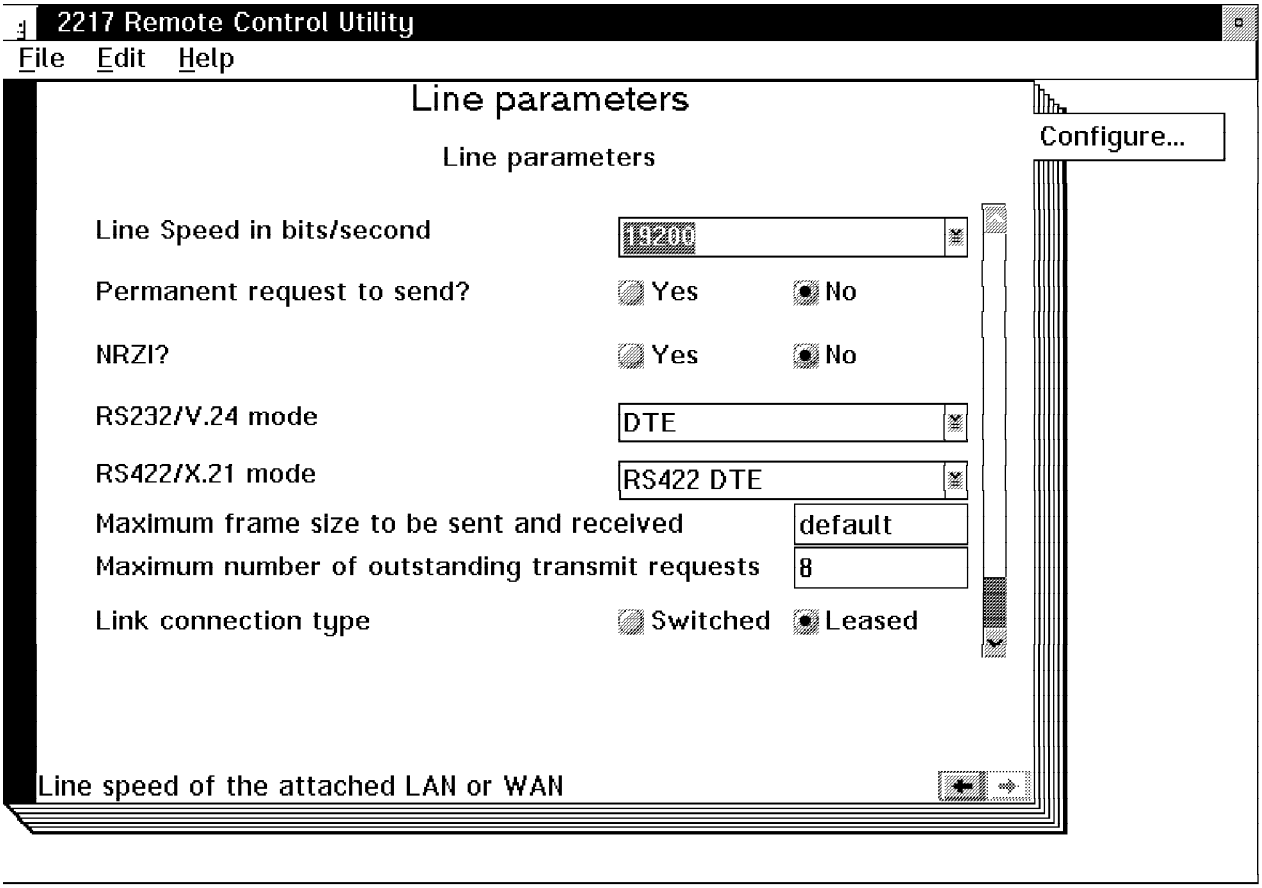


Figure 24. Frame Relay DLC to 2217-B - Line Parameters for WAC 1-0

- **Line Speed in bits/second:** This field specifies the clock speed used when the port generates the clocking signal. When in normal DTE mode, the clocking is generated by the modem or DSU/CSU, and this parameter is ignored. The port generates clocking in all DCE modes and in the RS232/V.24 mode. To change the default of 19200:
  1. Click on the arrow on the right side of the list box to expand the list.
  2. Click on the speed you want to use. The following speeds are available (in bps): 2M, 1.5M, 1M, 768K, 512K, 256K, 64K, 19200, 9600, 4800, 2400, and 1200
- **Permanent request to send?:** This specifies whether half-duplex transmission facilities or full-duplex transmission facilities are used. Most modern communications facilities are full-duplex and require constant RTS for point-to-point lines and the primary end of SDLC lines. Select **No** for switched RTS (Line Turnaround Required) if either half-duplex communications facilities are being used or the line is the secondary end of a multidrop SDLC line.
- **NRZI?:** This specifies whether non-return-to-zero inverted (NRZI) encoding is used for synchronous connections. The devices at each end of a physical

connection must use the same encoding method. For example, if this port is connected on a leased line to an NCP, the encoding method is part of the NCP line definition. For X.25 and frame relay links, the encoding method should match what is being used by the network data circuit-terminating equipment (DCE).

- **RS232/V.24 mode:** This field specifies the clocking modes used if the RS232/V.24 card is installed:
  - DTE when connected to a modem that generates the clocking.
  - DTE pin24 TXC when connected to a modem that requires the DTE to generate Tx clock on pin 24.
  - DCE when the WAC provides both Rx and Tx clocks. (DCE mode requires the use of a crossover adapter as described in the *2217 Planning Guide*.

  To change the default of DTE:

  1. Click on the arrow on the right side of the list box to expand the list.
  2. Click on the name of the mode you want to use.

- **RS422/X.21 mode:** This field specifies the clocking modes used if the RS422/X.21 card is installed:
  - RS422 DTE mode. (This mode requires the RS422 cable.)
  - X.21 DCE TxC_Echo mode. (The attached DTE must echo the clock back on the B line to be used for clocking data into the Wide Area Connector. This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.)
  - Normal X.21 DCE mode. (This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.)
  - Normal X.21 DTE mode.
  - X.21 DTE TxC_Echo mode. (The clock received on the S line is echoed on the B line to eliminate Tx clocking skew on long cables.)

  To change the default:

  1. Click on the arrow on the right side of the list box to expand the list.
  2. Click on the name of the mode you want to use.

- **Maximum frame size to be sent and received:** This field specifies the maximum size data frame that can be processed. It is used by the MAC driver to allocate buffers and must be set larger than any expected data and header size used by the higher protocol. However, if it is set unnecessarily high, buffer space is wasted. In particular, this value must be larger than the Maximum I-Field Size specified in the SNA DLC Characteristics panel for this port. For all interface types except X.25, a value 20 bytes larger than the Maximum I-Field Size is recommended. For X.25 interfaces, a value 10 bytes larger than the maximum packet size used on any virtual circuit is recommended. If you specify DEFAULT for WAC, the RCU selects 4486 or 2080, depending on the DLC Type specified. The default is 4486 for the frame-relay network and 2080 for SDLC and X.25.
- **Maximum number of outstanding transmit requests:** This field specifies the number of outstanding transmit requests supported by the device driver for the line attached to the frame-relay device driver.

- **Link connection type:** This is only used for SDLC or X.25 links. Frame relay links must be leased.

2.6.1.4 Line Parameters - WAC 1-1

In a similar way, you configure the line parameters for the frame relay connection to 2217-C.

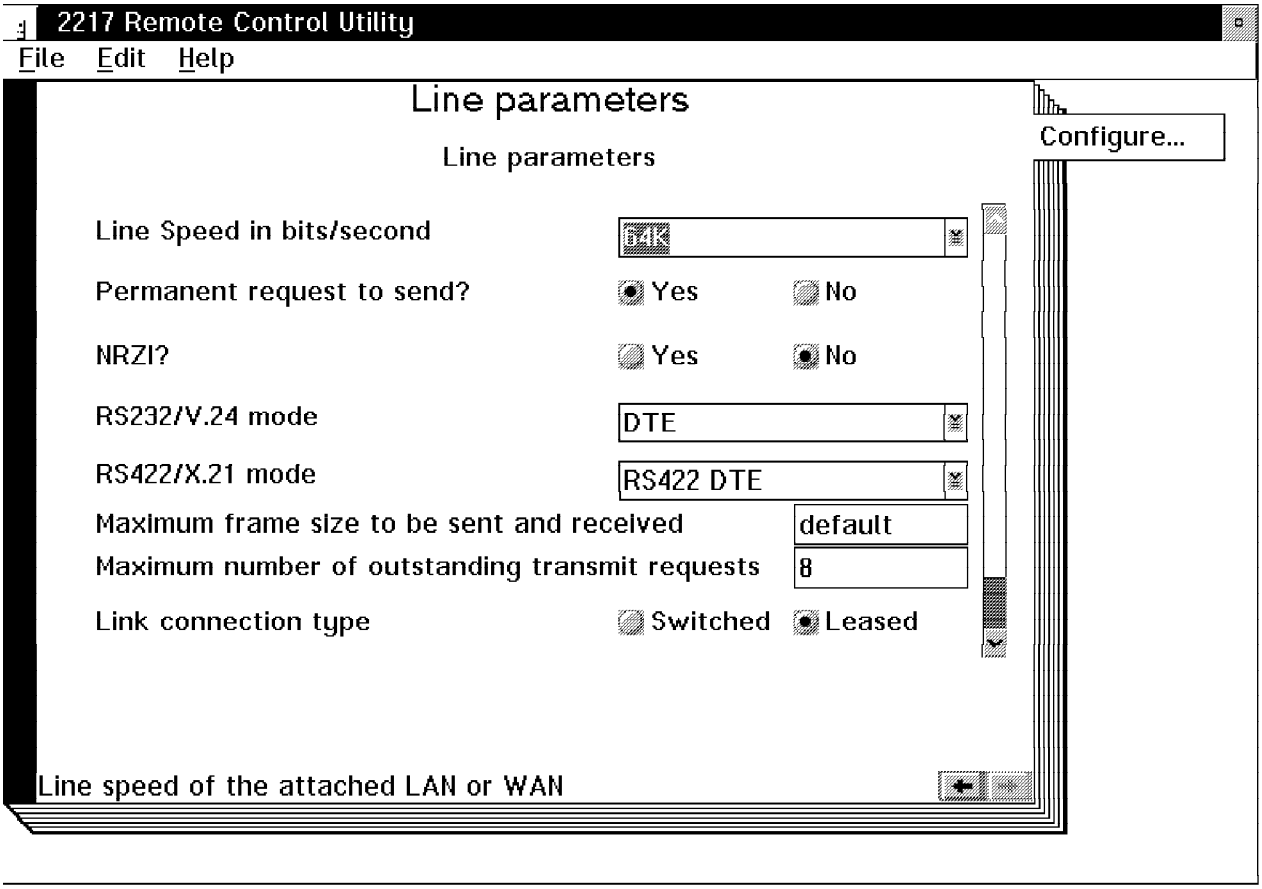


Figure 25. Frame Relay DLC to 2217-C - Line Parameters for WAC 1-1

2.6.1.5 Frame Relay Parameters - General

In this panel, you define the frame relay parameters for the connection to 2217-B.

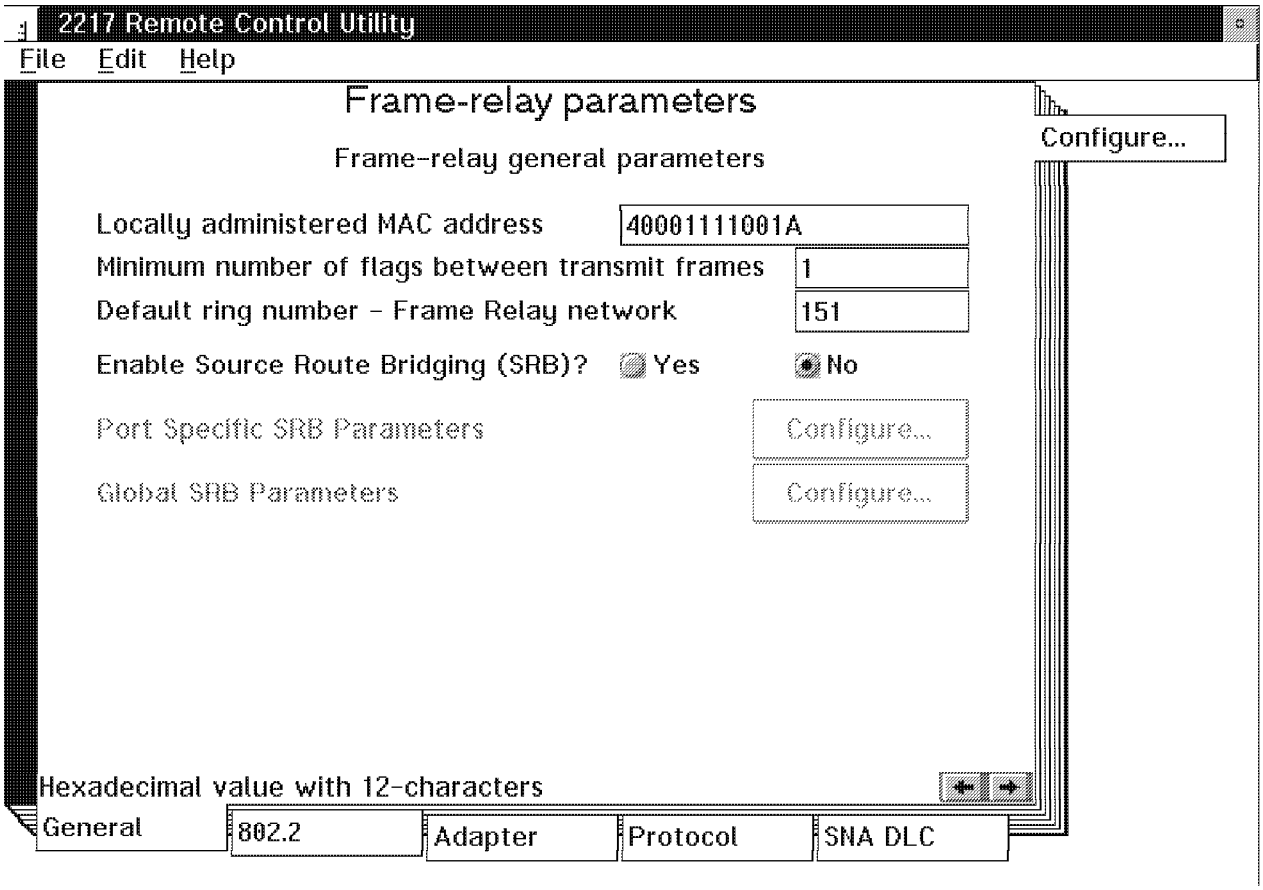


Figure 26. Frame Relay Parameters - General

- **Locally administered MAC address:** Enter the MAC address. In this scenario, 2217-A is using 40001111001A.
- **Default ring number - Frame Relay network:** This field specifies the ring number of the frame-relay network when viewed by the 2217 as a logical LAN. All bridges on the frame-relay network should use the same ring number. The ring number used for this frame-relay network should be distinct from all ring numbers used on LANs and other networks that can be reached from this network. In this scenario, we are using a ring number of 151.

2.6.1.6 Frame Relay Parameters - 802.2

In this configuration, we are using default values for the 802.2 parameters as follows:

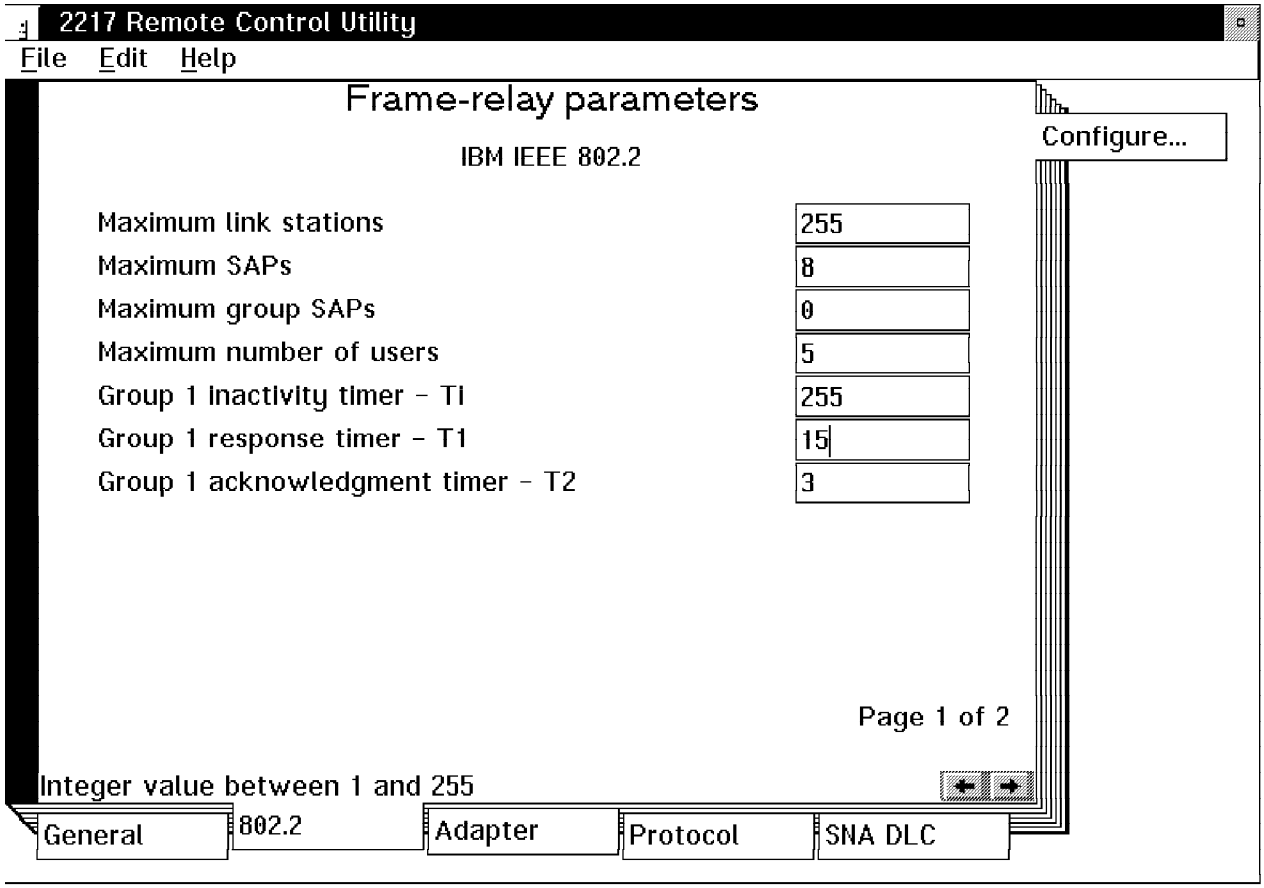


Figure 27. Frame Relay Parameters

- **Maximum number of users:** This field specifies the maximum number of applications that can use the protocol concurrently. SNA is considered to be one user, and so is NetBIOS.
- **Group timers:** All those values are referred to as multipliers, without specifying what exactly that means. They are in fact multiples of 40 milliseconds.

2.6.1.7 Frame Relay Parameters - SNA DLC

In this panel, we define the parameters related to SNA data link control (DLC).

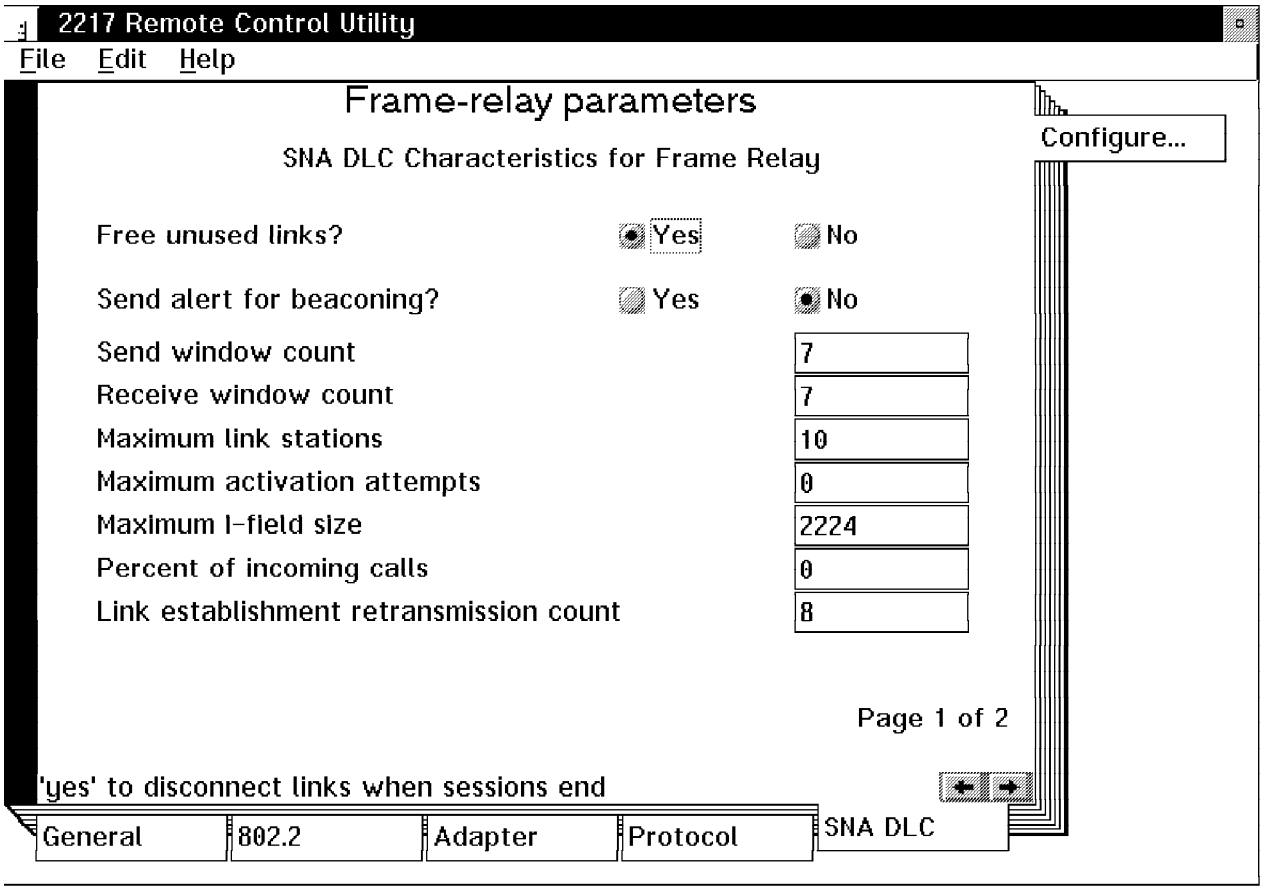


Figure 28. SNA DLC Characteristics (WAC 1-0)

The only value that was changed on this panel was the Maximum I-Field size. It needs to be set to 2224 for Frame Relay which is the recommended value for APPN/HPR. For further information on frame relay parameters, see Chapter 10, “Frame Relay and Source Route Bridging” on page 221.

2.6.1.8 Frame Relay Parameters - General to 2217-C

In a similar way, we define in this panel the frame relay general parameters for the connection to 2217-C (WAC 1-1).

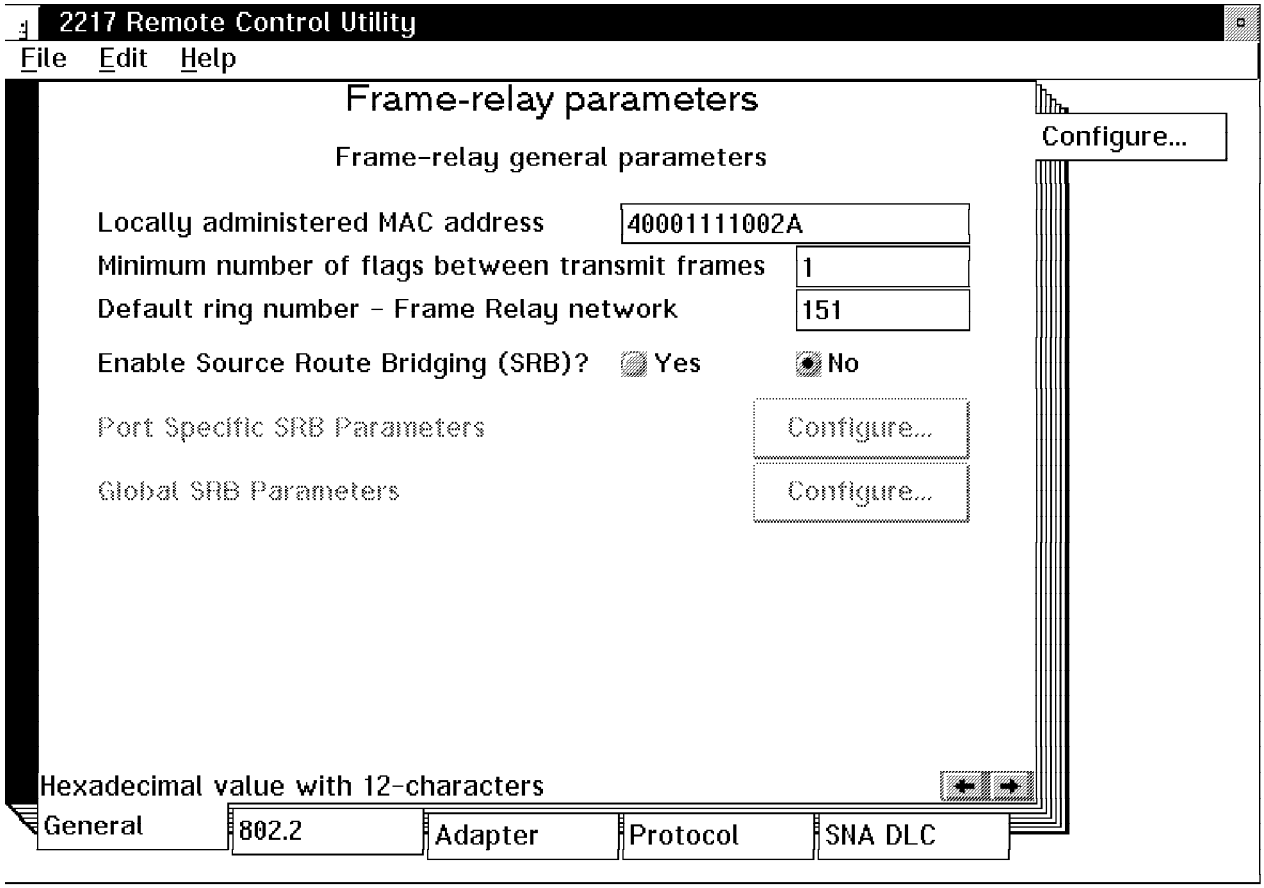


Figure 29. V.24 Link to 2217-C (WAC 1-1)

Notes:

1. Locally administered MAC address is 40001111002A in this case.
2. Ring number is also 151.

2.6.1.9 SNA Local Node Characteristics

In this panel, you must define the local node characteristics such as the Network ID and the CP name of the 2217.

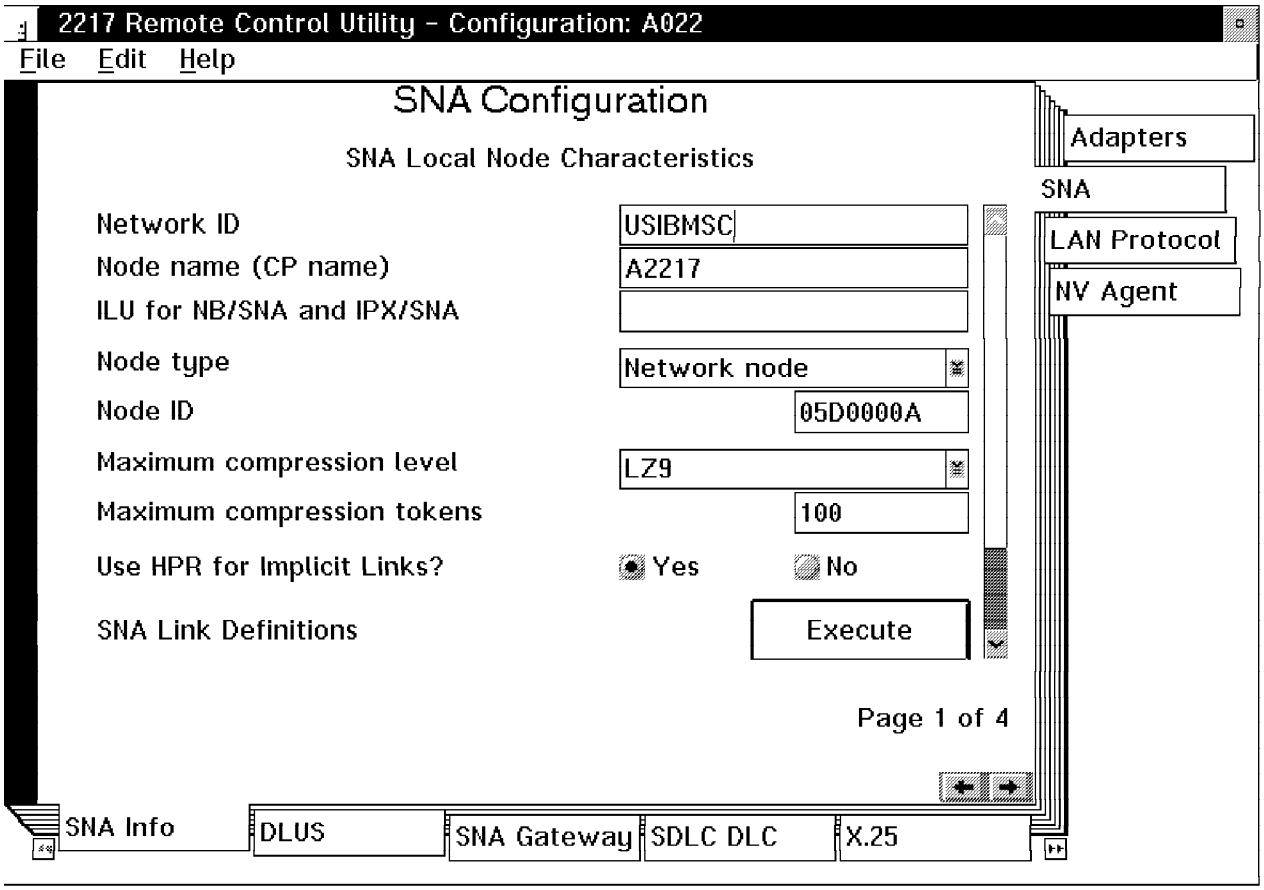


Figure 30. SNA Local Node Characteristics

- **Network ID:** This must be changed from the initial ANYBOX to reflect the proper network ID. In this scenario, the network ID is USIBMSC.
- **Node name:** Also known as CP name. This is initially set to IBM2217. Change this to the CP name you will be using for this machine. For 2217-A, the CP name is A2217 in this configuration.
- **ILU for NB/SNA and IPX/SNA:** Not used in this configuration.
- **Node type:** The node type can be:
  - End node if either the 2217 participates in an APPN network using a network node server (a network node server is a workstation that provides directory and routing services for your workstation), or the 2217 does not have access to a network node server and operates as an LEN node.
  - Network node if your workstation serves as an APPN network node server. A network node server provides the following services for workstations in its node:
    - Intermediate session routing (ISR) or High Performance Routing (HPR)
    - Directory services

- Topology and route selection services

Note

If you are planning to use the SNA over TCP/IP Gateway function in the 2217, you must configure the 2217 as a network node (NN).

To change the default:

1. Click on the arrow on the right side of the list box to expand the list.
2. Click on the name of the mode you want to use.

- **Node ID:** You may change the node ID. However, this is only used for the XID exchange upon link activation. It is not required unless the 2217 is connected to a 37x5. The station with the higher value will become the primary link station. Even though it is not required in this case we have specified the Node ID anyway.
- **Maximum Compression Level:** This field specifies the maximum level at which any session can be started:
  - None for no compression
  - RLE for Run Length Encoding
  - LZ9for Lempel-Ziv 9 Bit Encoding (default)

  The 2217 uses data compression for ILU sessions. These ILU sessions are used for multiprotocol sessions across an SNA backbone. If you use any option other than None, you must enter a value in the next field, Maximum Compression Tokens.

  Note that many COS values default to the initial adapter values (that is, the values as configured in the related DLC, which sometimes may not be changed either). Therefore, it is not possible to use the modes #INTERCS or #BATCHCS, which use SNA data compression, on a token-ring link, because the COS related to these modes requires a secure link, and the token-ring DLC defaults to NONSECURE. Although this is a scenario which was never designed to be supported, there may be a need to have a link that uses SNA data compression on a token-ring LAN in certain cases (see Figure 31). To set this up properly, you would have to create your own mode, configure it for compression, and use a COS that does not require a secure link (#BATCH, for example).

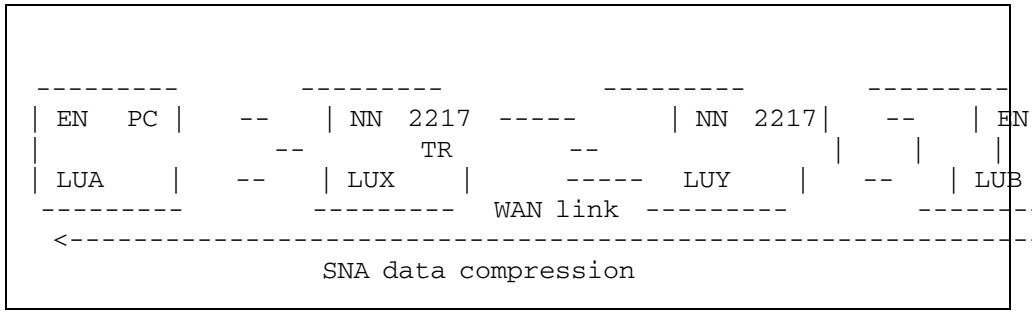


Figure 31. SNA Data Compression in a Token-Ring Scenario. The compression is performed by the LUs in the ENs; compressed RUs flow over the link unchanged by intermediate nodes.

- **Maximum compression tokens:** This field specifies the number of tokens to be dedicated for data compression. The minimum number of tokens you can

configure must be at least the number of tokens required to support one session at the selected compression level. The default is 100. However, a recommended value is 50 per concurrent SNA session active on the link.

Note

You should be aware that compression tokens use RAM that is not shared; if you will not use compression, you can free up memory for other tasks by setting the number of tokens to 0.

- **Use HPR for Implicit Links?:** Select **Yes** if the 2217 should try to use HPR for undefined links.
- **SNA Link Definitions:** Execute this option to define your explicit SNA links.

2.6.1.10 SNA Links

The SNA links and their characteristics are defined via the SNA Link definition panel which you will get to by clicking on the **Execute** button on the SNA Local Node Characteristics (see Figure 30 on page 52). In this configuration, we need SNA links to the network nodes 2217-B and 2217-C.

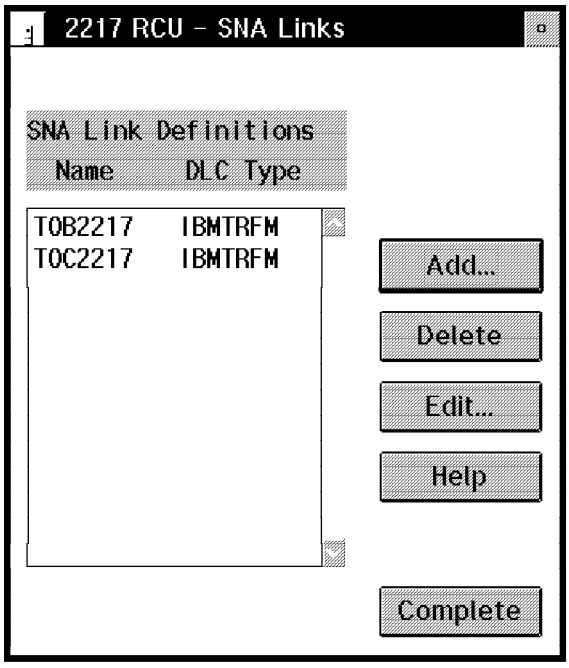


Figure 32. SNA Link Definitions

Next, you edit the SNA Link definition, select **Frame Relay** as the DLC type and define a network node connection.

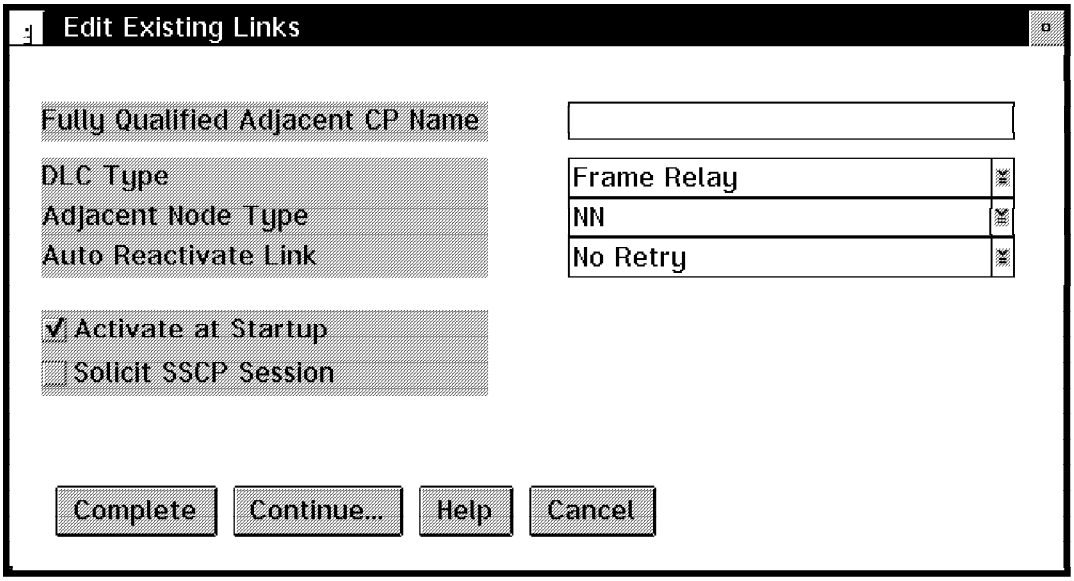


Figure 33. Link Definition for Frame Relay Link to 2217-B

- **Fully Qualified Adjacent CP Name:** This is an optional field. Here you may want to enter the fully qualified name of the partner CP where this link is going to. If this name is specified, the CP name will be verified in order to establish the connection. We normally recommend leaving this name blank.
- **DLC Type:** Here you specify the type of DLC used for this logical link. The default is Token Ring. Other selections are Ethernet, SDLC, Frame Relay and X.25 . As with all selection boxes which have an arrow on the right, to change the default:
  1. Click on the arrow on the right side of the list box to expand the list.
  2. Click on the name of the type you want to use. Frame Relay is selected for this configuration.
- **Adjacent Node Type:** This field specifies the type of node at the remote end of your connection. The default is LEN. Other selections are NN and LEARN.
  - LEN (low entry networking) if the partner node is a LEN. LEN nodes can participate in APPC communications but cannot make direct use of the APPN services provided by a network node server. An example of a LEN node is an OS/2 EE 1.2 or 1.3 Communications manager node without Networking Services installed.
  - NN (network node) if the partner node is one that can serve end nodes in its network with the full range of APPN services. Directory and topology services are only provided on the link if CP-CP sessions are established. If these services are required, the CP-CP Session Support check box must be selected.
  - Learn if the 2217 learns the node type of the remote node using XID negotiations during link establishment. This option is recommended if you are not sure what node type the remote node is.
- **Auto Reactivate Link:** Select no retry or infinite retry.
- **Activate at Startup:** This specifies whether you want the link to be activated when the 2217 is started. This is selected by default. If you choose to deselect this you can still activate it using one of the following methods:

- The partner node can activate the link; this means that the link is activated by an incoming connection.
- You can use RCU Operations to activate the link manually.

- **Solicit SSCP Session:** This check box specifies whether the link you are defining is used for sessions between the system services control point (SSCP) on a host computer and the physical unit (PU), or control point, in the 2217. You can specify Yes for a host link when the 2217 is providing SNA gateway function for workstations to access the host.

2.6.1.11 Additional Link Parameters to 2217-B

By selecting **Continue** when editing an SNA link, you can configure the additional link parameters.

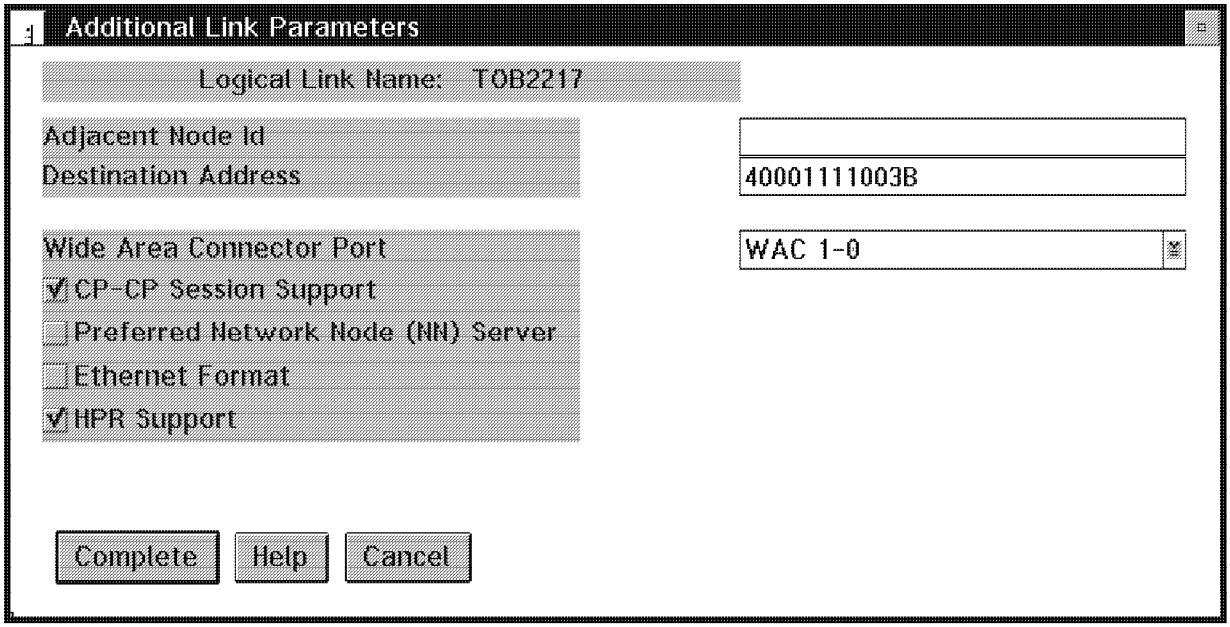


Figure 34. Additional Link Parameters

- **Adjacent Node ID:** This field specifies the eight characters used by the partner node in the exchange identification (XID) for activating a link. In station negotiations, the workstation with the higher value becomes the primary link workstation. If equal, both workstations generate a random number to determine which is primary.

  Notes:

  1. Do not enclose the value in hexadecimal symbols. For example, enter 05D01ABF, not X'05D01ABF'.
  2. If you type less than five digits in the second part of the field, the system pads the value with leading zeroes.
  3. If you specify a value for the Destination Address, you cannot enter a value in this field.
  4. If you enter a value in this field, instead of specifying a value for the Destination Address, the link can be activated only by the partner node.

- **Destination Address:** This field is mutually exclusive with the previous field.

- For token-ring or Ethernet links this field specifies the 12-character hexadecimal address of the adapter on the node to which you are defining the connection and, optionally, the two-character hexadecimal service access point (SAP) for the remote node. Since this is the link to our 2217-B machine, we entered the MAC address of its WAC 1-0 port where the link to 2217-A is established.

  Note: The following restrictions apply:

  - The first character of a LAN destination address must be a digit between 0 and 7.
  - The remaining characters can be any alphanumeric characters (A-F, 0-7).

  Depending on your network, the LAN destination address is one of the following:

  - The node address or the medium access control (MAC) address defined in the configuration for the controller's network adapter on an IBM token-ring network or an Ethernet.
  - A permanent address encoded in the controller's network adapter by the manufacturer.
  - An address assigned within your network to the controller's network adapter.

  Your LAN administrator can tell you the LAN destination address to use.
- For frame-relay links, this field can be either the real MAC address of the remote node's frame-relay interface or a virtual MAC address.
- For SDLC links where the 2217 is the primary station, this field specifies the 2-character (hexadecimal) value. Normally FF is used unless the secondary station does not support the broadcast address.
- For SDLC links where the 2217 is a secondary station, this field specifies the 2-character (hexadecimal) secondary address of the 2217.
- For X.25 links, this field is not used.

- **Wide Area Connector Port:** This check box specifies which one of the WAC adapters will be used for this link. To change the value, click on the arrow to expand the box and select the WAC port you want to use. In this configuration, we use WAC 1-0 for the frame relay connection to 2217-B.
- **CP-CP Session Support:** Select this option to request APPN support (CP-CP sessions).
- **Preferred Network Node Server:** This check box specifies whether the link is a network node (NN) that will be the NN server for the 2217. Only one link can be selected as the NN server.
- **Ethernet Format:** When using Ethernet, it refers to the address format used. When it is not selected, the default is the token-ring format.
- **HPR Support:** This check box allows you to activate HPR for this specific link. The default is Not Selected. In this configuration, we select HPR.

2.6.1.12 Additional Link Parameters to 2217-C

Similarly, we define the additional link parameters to 2217-C and we select CP-CP session support (APPN) and HPR over frame relay.

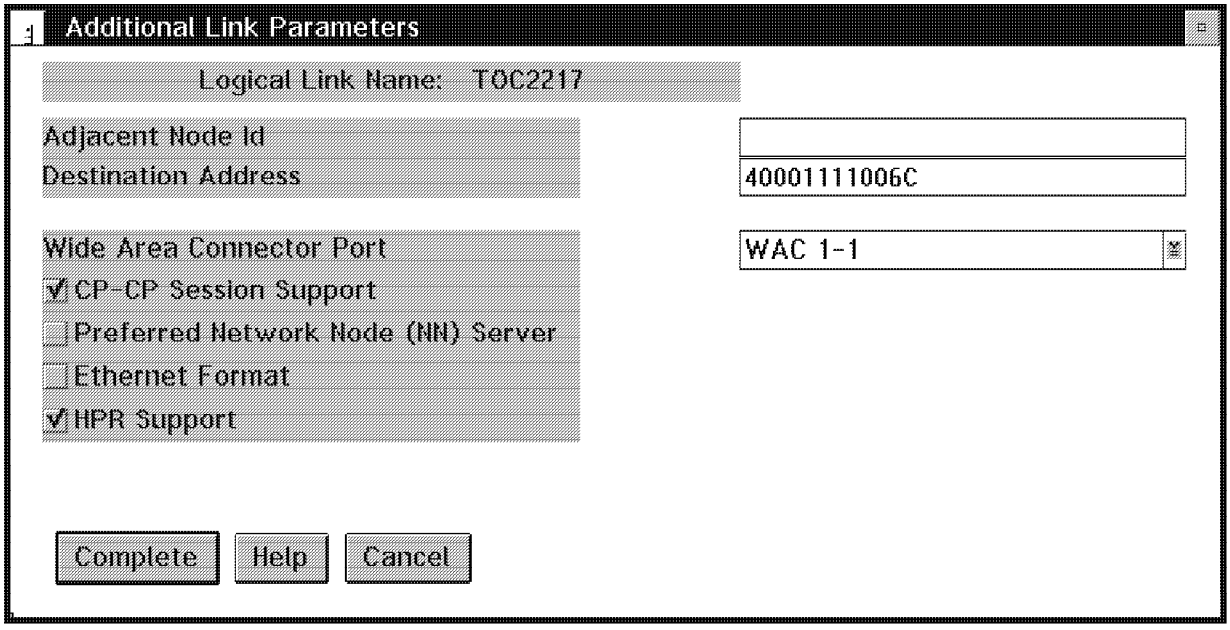


Figure 35. Selecting HPR over Frame Relay Link to 2217-C (WAC 1-1)

2.6.2 Monitoring HPR Connections

Since PC-A is running Communications Server 4.0, you may want to use the CMCONNS command to monitor your HPR connections. For example, if you establish APPC sessions from PC-A to PC-B, these sessions using the same class of service (COS) will flow over an HPR connection from PC-A to 2217-A to 2217-B and to PC-B. In this case, 2217-A and 2217-B are network nodes and therefore provide the routing support using ANR.

The following figure shows the display of the CMCONNS command entered at PC-A:

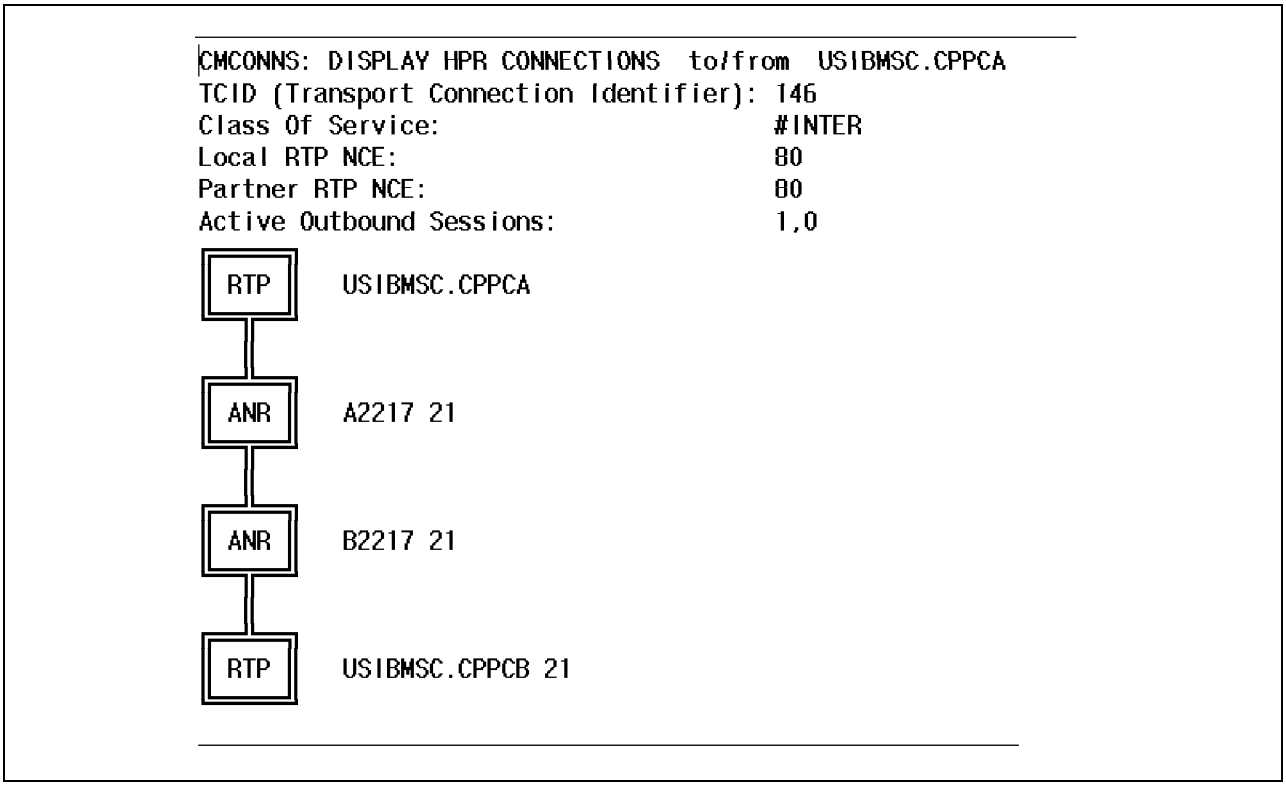


Figure 36. CMCONNS Display of Initial HPR Connection

When the link between 2217-A and 2217-B fails, HPR will do a non-disruptive path switch. The HPR connection now goes from PC-A to 2217-A to 2217-C to 2217-B and to PC-B and the session remains active as shown in the following display of the CMCONNS command:

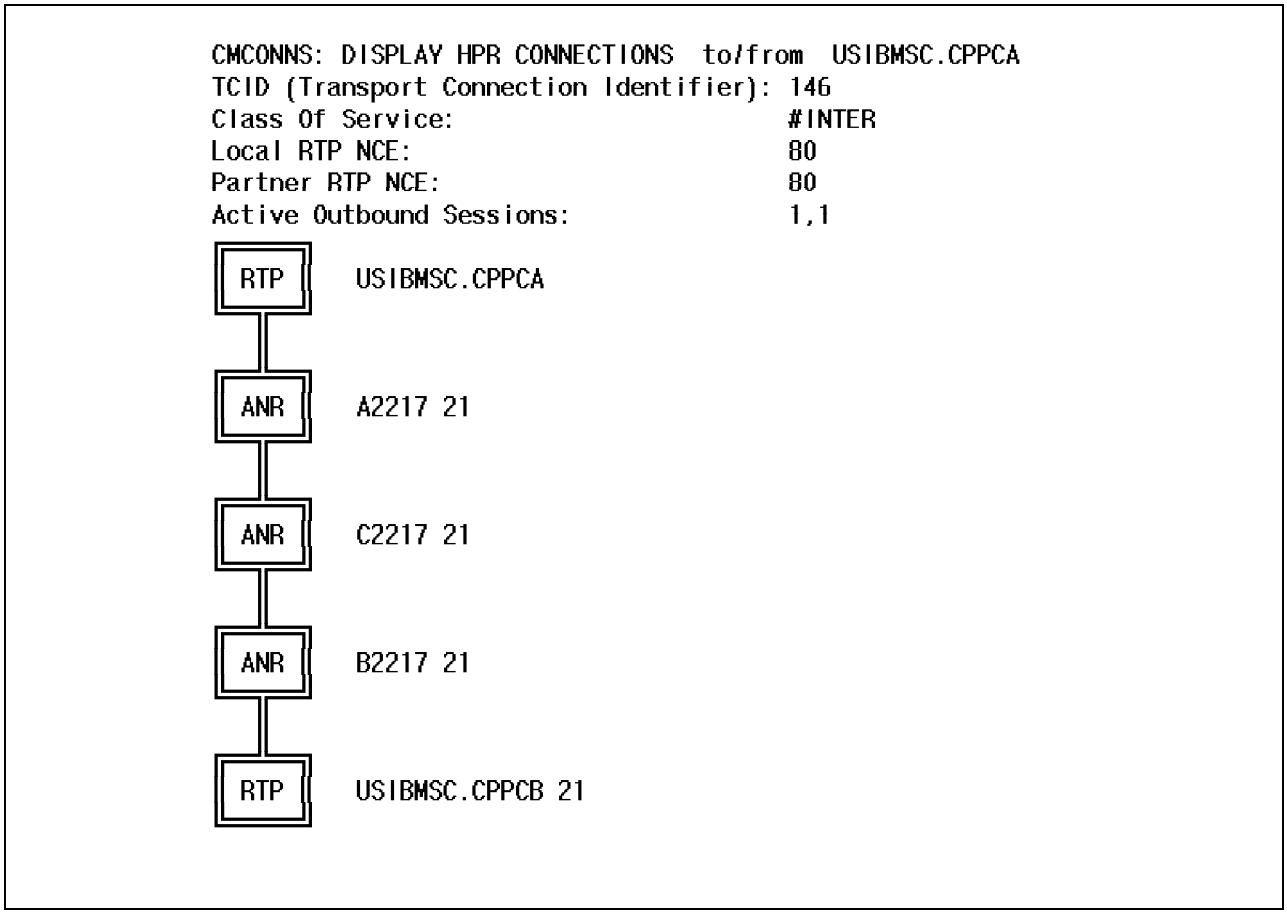


Figure 37. RTP Connection After Non-Disruptive Path Switch

The route will not be recalculated once the link between A and B becomes active again. To force a recalculation of the route, you must issue the CMCONNS command with the option -s including the TCID (Transport Connection Identifier) number. The TCID number is displayed in the CMCONNS command.

For example, in this case, you may want to enter the following command in order to let HPR calculate the best route for the sessions with #INTER class of service:

```
CMCONNS -s 146
```

2.6.3 Workstation Configuration

In this section we show you the Communications Server 4.0 configuration used in PC-A. Two links are defined to NN 2217-A:

- **TOA2217:** is an EN-to-NN link, which is the connection we want to configure.
- **TA2217N:** is an LEN connection to 2217-A to be used initially with the original 2217 CP name and T/R address. It is not activated at startup and will be manually activated when required.

```
DEFINE_LOCAL_CP  FQ_CP_NAME(USIBMSC.CPPCA    )
                 CP_ALIAS(ENB    )
                 NAU_ADDRESS(INDEPENDENT_LU)
                 NODE_TYPE(EN)
                 NODE_ID(X'05D05158')
                 DLUR_MULTISUBNET_SUPPORT(YES)
                 ...................................
DEFINE_LOGICAL_LINK  LINK_NAME(TOA2217)
                 ADJACENT_NODE_TYPE(NN)
                 PREFERRED_NN_SERVER(YES)
                 DLC_NAME(IBMTRNET)
                 ADAPTER_NUMBER(0)
                 DESTINATION_ADDRESS(X'40002217000A04')
                 ETHERNET_FORMAT(NO)
                 CP_CP_SESSION_SUPPORT(YES)
                 SOLICIT_SSCP_SESSION(NO)
                 ACTIVATE_AT_STARTUP(YES)
                 HPR_SUPPORT(YES)
                 ...................................
DEFINE_LOGICAL_LINK  LINK_NAME(TA2217IN)
                 ADJACENT_NODE_TYPE(LEARN)
                 DLC_NAME(IBMTRNET)
                 ADAPTER_NUMBER(0)
                 DESTINATION_ADDRESS(X'40002217FFFF04')
                 ETHERNET_FORMAT(NO)
                 CP_CP_SESSION_SUPPORT(NO)
                 SOLICIT_SSCP_SESSION(NO)
                 ACTIVATE_AT_STARTUP(NO)
                 HPR_SUPPORT(NO)
                 ...................................
DEFINE_DEFAULTS  IMPLICIT_INBOUND_PLU_SUPPORT(YES)
                 DEFAULT_MODE_NAME(BLANK)
                 ...................................
                 IMPLICIT_LINK_HPR_SUPPORT(YES)
                 RETRY_COUNT(6)
                 ALIVE_TIMER(60)
                 PATH_SWITCH_TIMER_LOW(480)
                 PATH_SWITCH_TIMER_MEDIUM(240)
                 PATH_SWITCH_TIMER_HIGH(120);
DEFINE_TP  TP_NAME(APINGD)
                 FILESPEC(c:\labtools\apingd.exe)
                 CONVERSATION_TYPE(ANY_TYPE)
                 TP_OPERATION(NONQUEUED_AM_STARTED)
                 PROGRAM_TYPE(WINDOW)
                 ...................................
START_ATTACH_MANAGER;
```

Figure 38. PC-A Workstation Configuration

Chapter 3. SNA over IP Gateway

IBM 2217 Nways MpC Release 2.0 provides an SNA over IP Gateway capability in this release. This functionality allows you to run SNA APPC and CPI-C applications over TCP/IP and SNA networks. The APPC and CPI-C Applications programs require no modifications.

One of the most important applications using this function is that you can now connect the Remote Control Utility (RCU) via TCP/IP to the IBM 2217 MpC in order to send a configuration, reboot or simply collect data from the IBM 2217 MpC. In this chapter, we describe this function and show you the configuration for two common scenarios using the IBM 2217 MpC as an SNA over TCP/IP Gateway.

3.1 APPC Applications over TCP/IP

The following figure illustrates how APPC and CPI-C applications run over TCP/IP and SNA networks using an IBM 2217 MpC to connect the two networks. In this case, the IBM 2217 Nways MpC Release 2.0 node is also configured to include, among other supported functions, a SNA over TCP/IP Gateway.

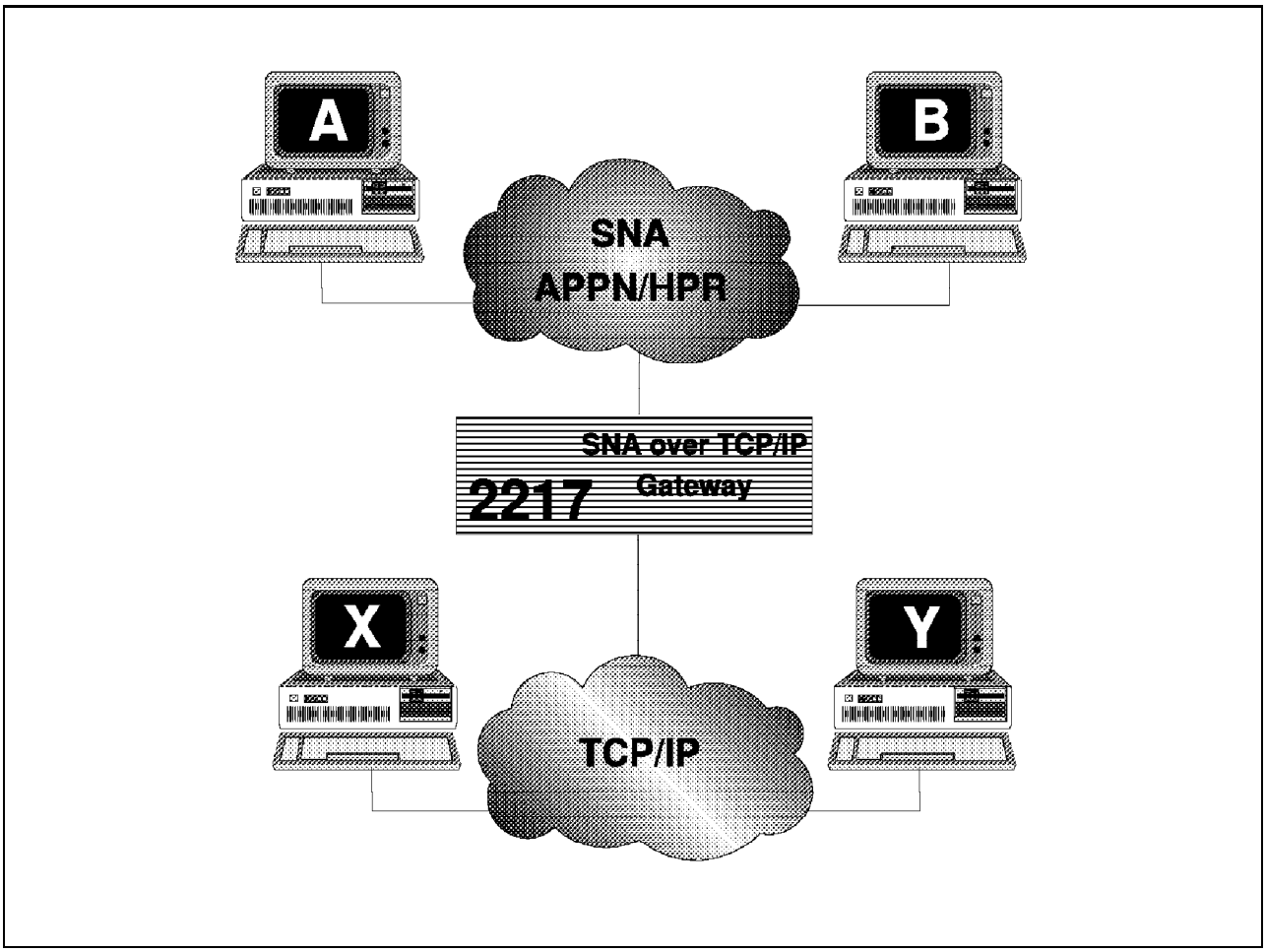


Figure 39. Running APPC Applications Using IBM 2217 MpC SNA over TCP/IP Gateway

In this scenario, APPC and CPI-C applications can execute in any node whether it is connected to a TCP/IP network or to an SNA network. Some SNA applications are also available in the IBM 2217 MpC and they can also be executed from other nodes. For example, you may want to APING the IBM 2217 MpC from either a TCP/IP or SNA connected node in order to test the connectivity.

3.1.1 SNA over TCP/IP Address Mapping

For IP networks that have APPC over TCP/IP or SNA over TCP/IP access nodes, before an SNA session can be set up between the local LU and a partner LU, the access node must determine the IP address of the node on which the partner LU resides. The access node maps the partner LU to the IP address using a two-step process:

- A domain name system (DNS) domain name that corresponds to the partner LU name is generated by the access node.
- The generated domain name is used to query the domain name server or hosts file. The response to the query is the appropriate IP address.

Note

When IBM 2217 MpC is used as an SNA over TCP/IP Gateway, you must use either a hosts file or a domain name server (DNS) to allow address mapping.

The following steps outline how a destination LU gets an IP address:

1. SNA over TCP/IP receives the destination LU name in the format netid.luname (fully qualified name).
2. SNA over TCP/IP takes the LU name (netid.luname) and generates a domain name in the format luname.netid.snasuffix.

   Note: The domain name must be added to the hosts file or the domain name server database.

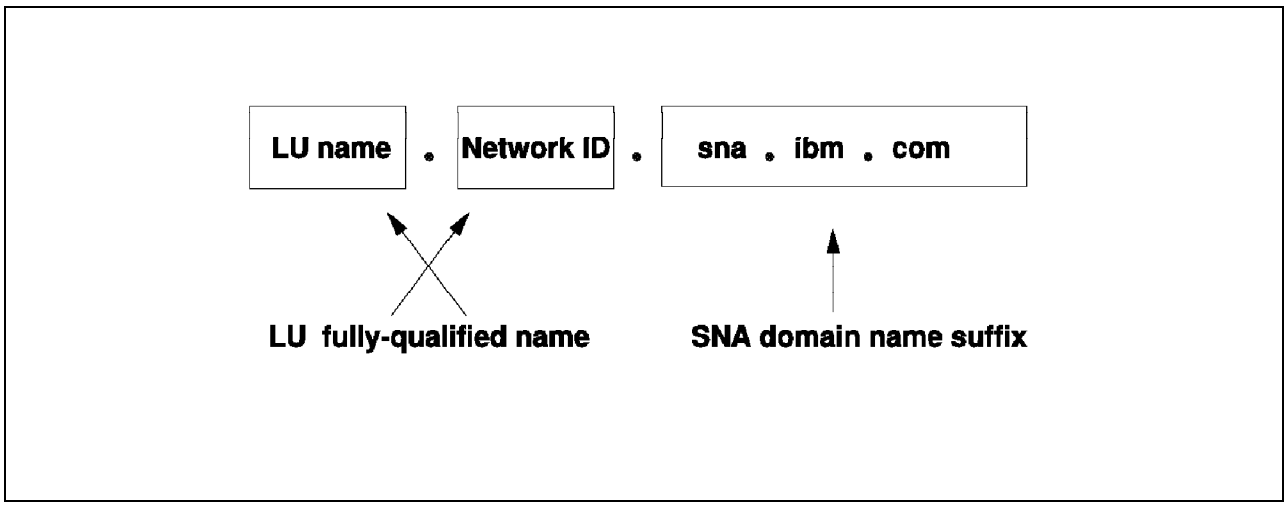


Figure 40. Domain Name Used by SNA over TCP/IP

3. SNA over TCP/IP requests that the domain name be translated into an IP address.

4. TCP/IP uses the hosts file or the domain name server to translate the domain name into an IP address (for example, luname.netid.sna.ibm.com translates to 9.67.192.28).

3.1.2 Defining Domain Names and IP Addresses

This section discusses the different methods that can be used to provide address mapping when using SNA over IP.

3.1.2.1 Hosts File

You can use the TCP/IP hosts file to define domain names and IP addresses for your network. However, as your network becomes larger and maintaining the hosts file on each end user workstation becomes too time consuming, it is recommended that you use the domain name server.

The hosts file lists the following:

- IP address
- Domain name
- Other aliases for the domain name

When you enter the information in the hosts file, include the IP address and the domain name in the format luname.netid.snasuffix. For example, if your IP address is 9.67.192.28, network ID is NETA1, LU name is LUA1, and SNA domain name suffix is SNA.IBM.COM, define the following:

```
9.67.192.28      LUA1.NETA1.SNA.IBM.COM
```

3.1.2.2 Domain Name Server

Domain names and IP addresses can also be defined in the domain name server database.

Each destination LU name is mapped to a corresponding IP address by a domain name server. You can use any domain name server to set up your configuration.

SNA over TCP/IP uses the TCP/IP name resolution function. This function uses a RESOLV file to locate the domain name server. If the domain name server is not accessible or the name cannot be found, TCP/IP searches the hosts file. The name of each logical unit that resides in an access node must be mapped to an IP address. If the LU resides on an SNA over TCP/IP access node, the LU name is mapped to the IP address of the access node.

Note: When running SNA applications over TCP/IP, be aware that there are restrictions on the characters used in LU names. LU names must:

- Start with a letter
- End with a letter or digit
- Contain only letters, digits, or the hyphen (-) character
- Be less than or equal to 63 characters in length

Existing SNA LU names that do not follow this naming convention need to be changed before they are used in a domain name.

For information on the hosts file, the domain name server, and the domain name system (DNS), refer to your TCP/IP documentation.

Note: If your workstations are using OS/2 Warp to support the name resolution function, refer to the online TCP/IP documentation that is included with the OS/2 Warp product.

3.1.3 Deciding Whether to Use the Hosts File or the Domain Name Server

Because the hosts file does not allow a domain name to be mapped to multiple IP addresses, you must use the domain name server rather than the hosts file in the following configurations:

- Configurations that use parallel SNA over TCP/IP gateways, because you have multiple IP addresses with the same domain name
- Configurations that support dependent LUs via DLUS/DLUR, because each dependent LU name is mapped to two IP addresses

  Note: A node that is configured as a downstream workstation is mapped to only one IP address.

Note

TCP/IP does *not* support wildcard entries when using a hosts file. If you plan to use wildcards, you must use a domain name server.

3.1.4 Managing the IP Network

Because SNA over TCP/IP operates as a TCP/IP application program, you can use Simple Network Management Protocol (SNMP) to provide network management of TCP/IP traffic that is routed through SNA over TCP/IP.

Because the NetView program provides SNMP support, you can use NetView Version 2 Release 1 (or higher), NetView for AIX Version 3 (or higher), and the NetView family of products to manage the IP network activity. The underlying IP network is managed by NetView for AIX, which is a service point to the NetView program.

NetView for AIX provides the following TCP/IP management:

- Generic support for Management Information Base 2 (MIB2) devices
- Support for fault and performance applications
- Support for Trouble Ticket/6000 applications
- Support for TCP/IP routers and SNMP devices

3.1.5 Managing the SNA Network

Because SNA over TCP/IP is a node in the SNA network, the NetView program can be used to provide network management of the SNA traffic that is routed through SNA over TCP/IP.

3.2 Sample Scenario 1: Using a Single SNA over TCP/IP Gateway

In this section, we include a configuration for a common scenario where we would like to run APPC or CPI-C applications over TCP/IP networks. In addition, we also have an SNA network; we should be able to run these applications from any workstation, whether it is connected to a TCP/IP network or to an SNA network.

You may want to use the CPI-C application APING to test your connections. Once you have APING running successfully, you may want to try other applications. APING can also be used to find network problems and to measure response times with different options, such as the number of iterations, session mode and packet sizes.

The following scenario will be configured to run APPC and CPI-C applications over TCP/IP and SNA networks:

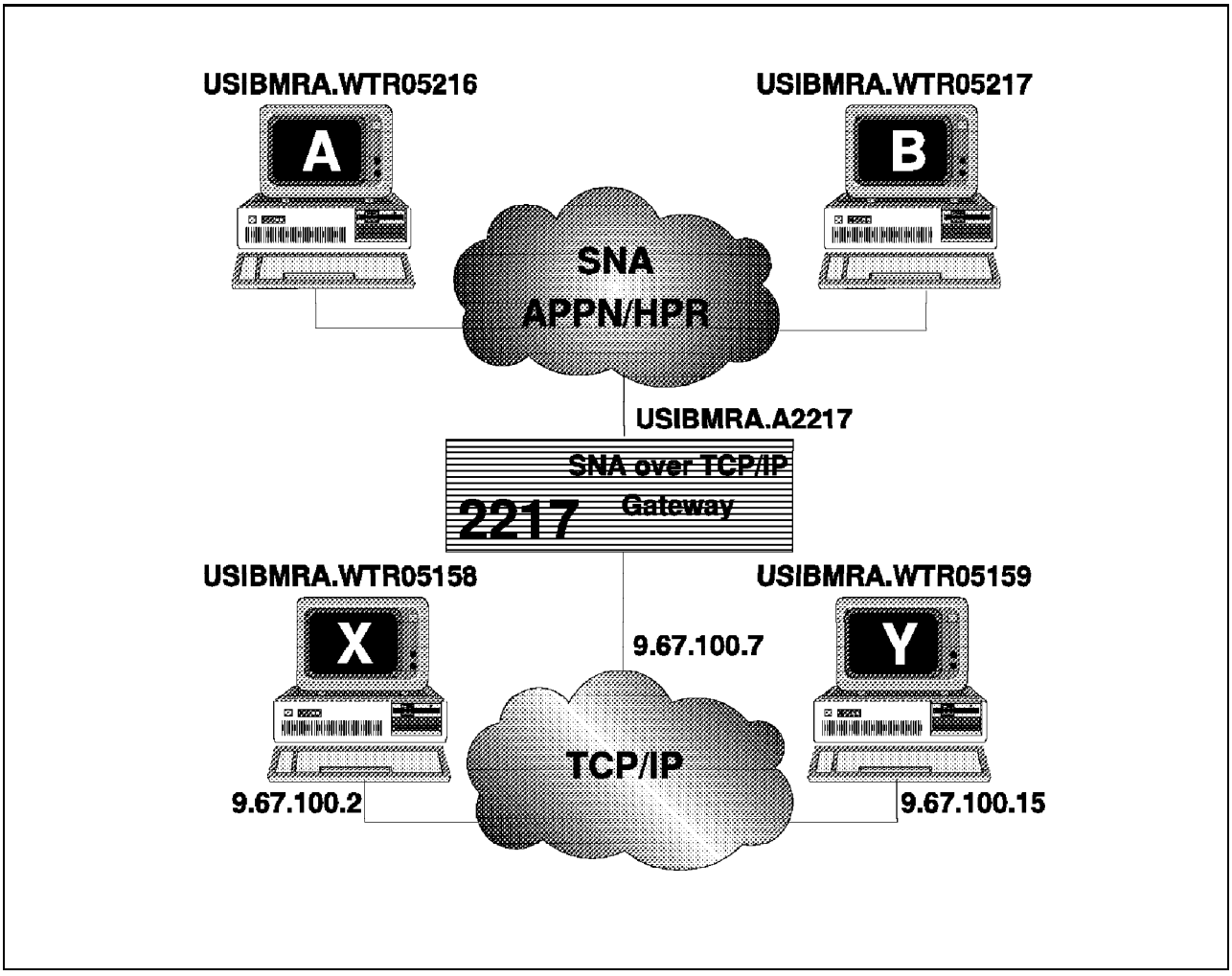


Figure 41. SNA over TCP/IP Scenario

3.2.1.1 Workstation A Configuration

Since this is a node connected to your SNA network, configure this node like any other APPC/CPI-C workstation connected to an SNA network. You may want to use the IBM 2217 MpC as your network node server. TCP/IP is not required to be installed in this node.

3.2.1.2 Workstation B Configuration

Since this is a node connected to your SNA network, configure this node as any other APPC/CPI-C workstation connected to an SNA network. You may want to use the IBM 2217 MpC as your network node server. TCP/IP is not required to be installed in this node.

3.2.1.3 IBM 2217 MpC SNA over TCP/IP Gateway Configuration

You must configure the IBM 2217 MpC as a network node (NN) connected to the SNA network.

- The IBM 2217 MpC node has all the capabilities of a workstation and therefore it is able to run some of the available APPC/CPI-C applications provided in the IBM 2217 MpC. For example, you can APING the IBM 2217 MpC from any node connected to either TCP/IP or SNA network.

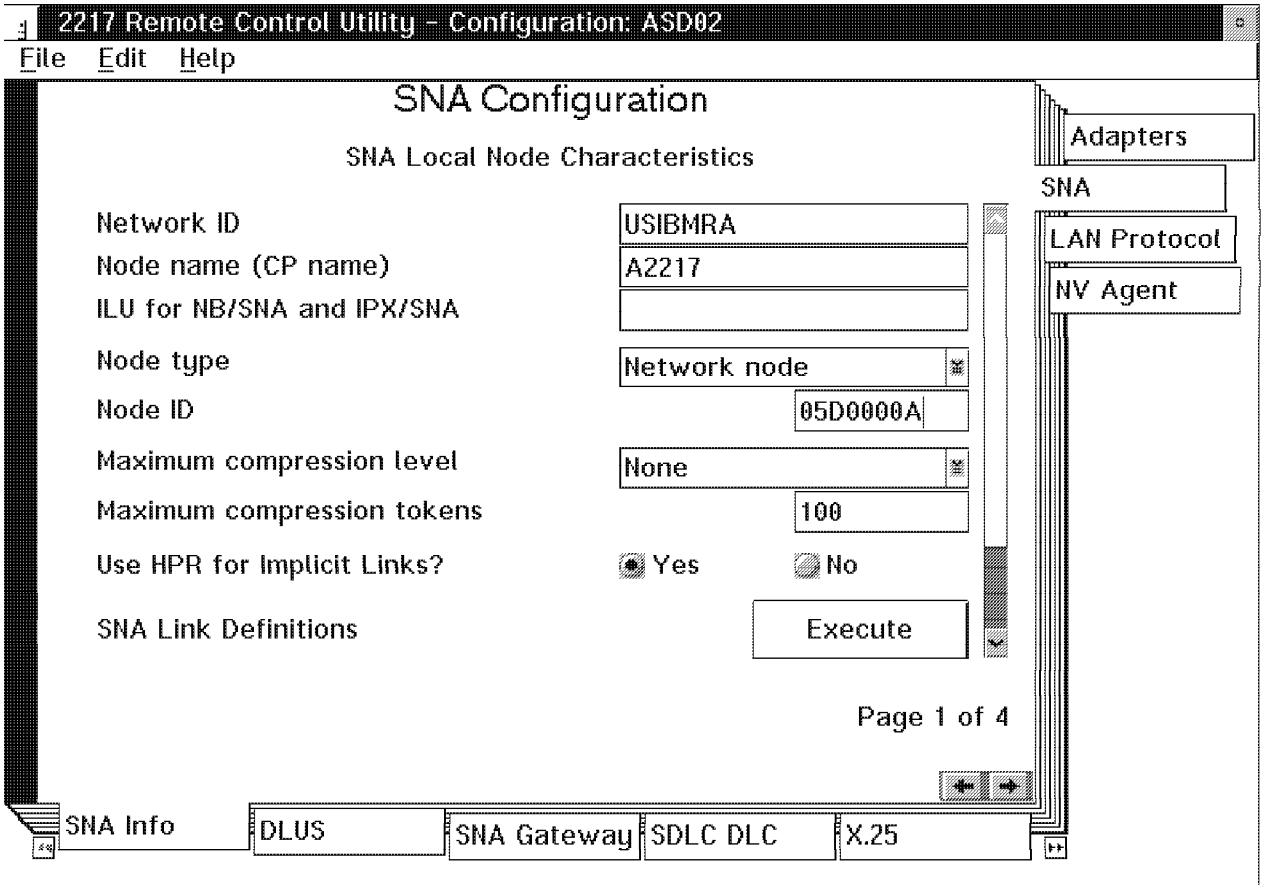


Figure 42. IBM 2217 MpC Local Node

- In RCU, configure SNA over IP Gateway.
  - You may want to change the default SNA domain suffix SNA.IBM.COM. This suffix is used for address mappings in your hosts or domain name server files. In this example, we use the default values.

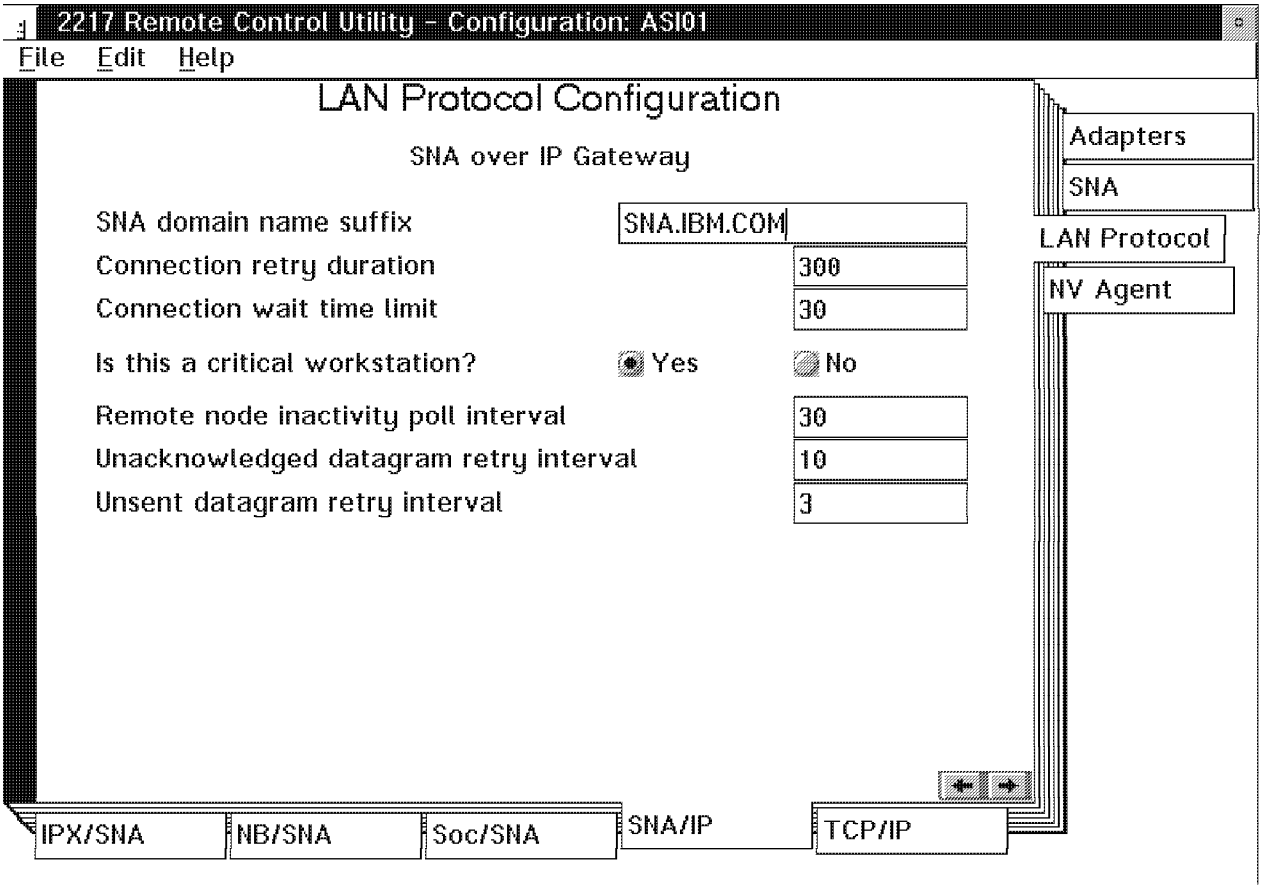


Figure 43. SNA over IP Parameters (Gateway)

- Configure TCP/IP with the local address 9.67.100.7 and subnet mask 255.255.255.0.
- For your address mappings, add the following entries to the hosts file:

```
9.67.100.2  WTR05158.USIBMRA.SNA.IBM.COM
9.67.100.15 WTR05159.USIBMRA.SNA.IBM.COM
```

3.2.1.4 Workstation X Configuration

Install and configure Communications Server or its client version (Access Feature).

- The configuration needs to include the local node definition; you also need to define any server TPs (transaction programs) that you may want to use, such as APINGD in order to be able to APING this workstation from any other SNA or TCP/IP attached node.
- In CMSETUP, configure the AnyNet base parameters.

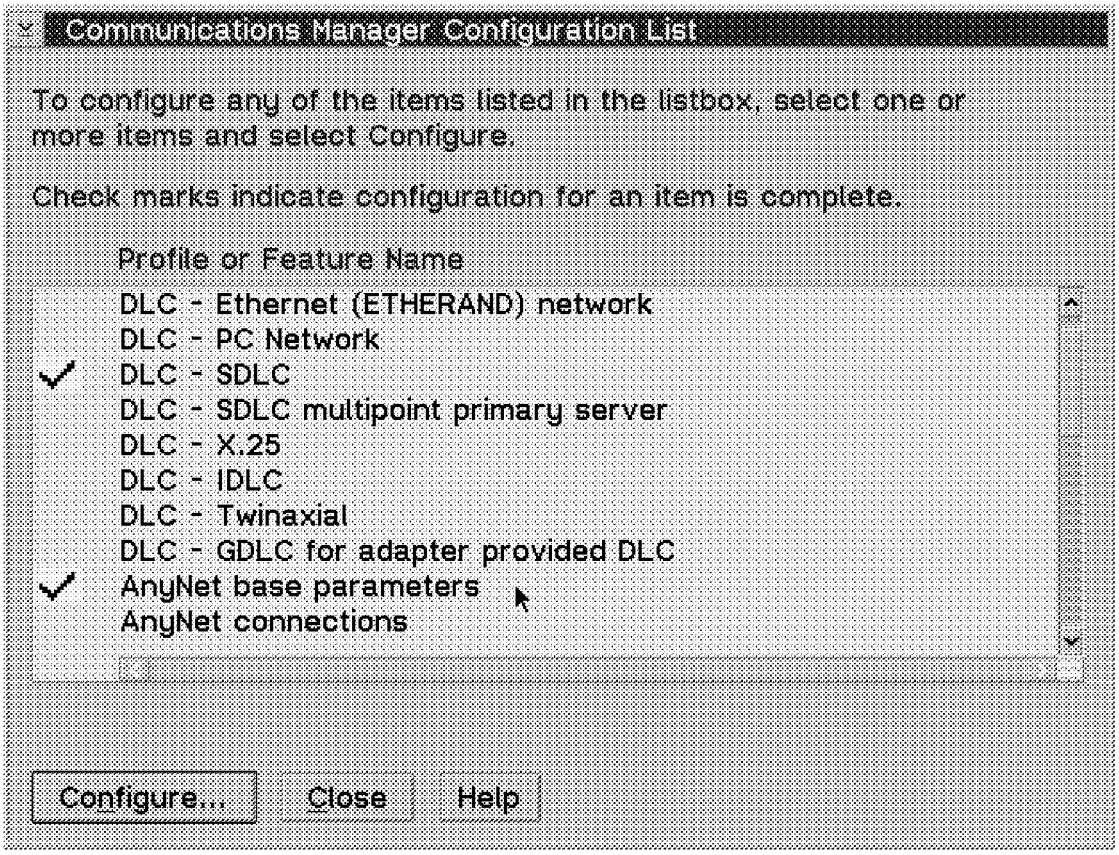


Figure 44. Selecting SNA over IP Parameters

- You may also want to change the default SNA domain suffix SNA.IBM.COM. This suffix is used for address mappings in your hosts or domain name server files. In this example, we use the default values.
- Select **Non-native first** (TCP/IP) as your routing preference. Communications Server or its client version (Access Feature) will search the TCP/IP network first.

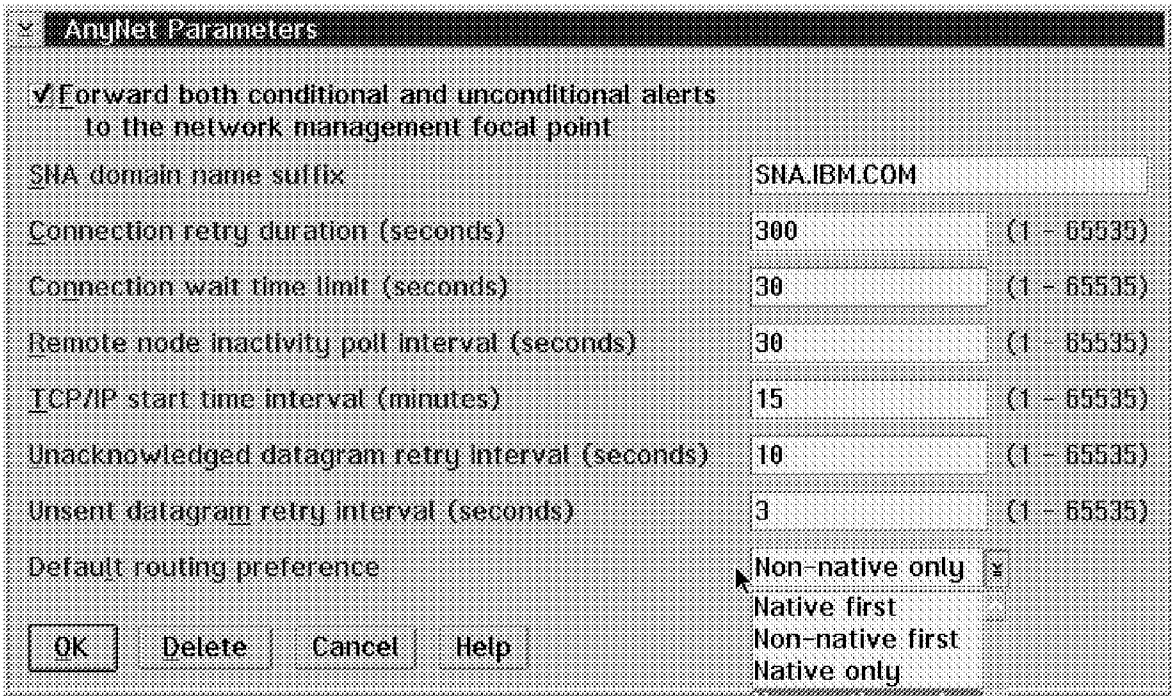


Figure 45. SNA over IP Parameters (TCP/IP Workstation)

Note

Although you have to install and configure Communications Server or its client version (Access Feature), neither links nor connections are required to run APPC or CPI-C applications using SNA over TCP/IP, since outbound traffic will use TCP/IP.

- Install and configure TCP/IP with the local address 9.67.100.2 and subnet mask 255.255.255.0.

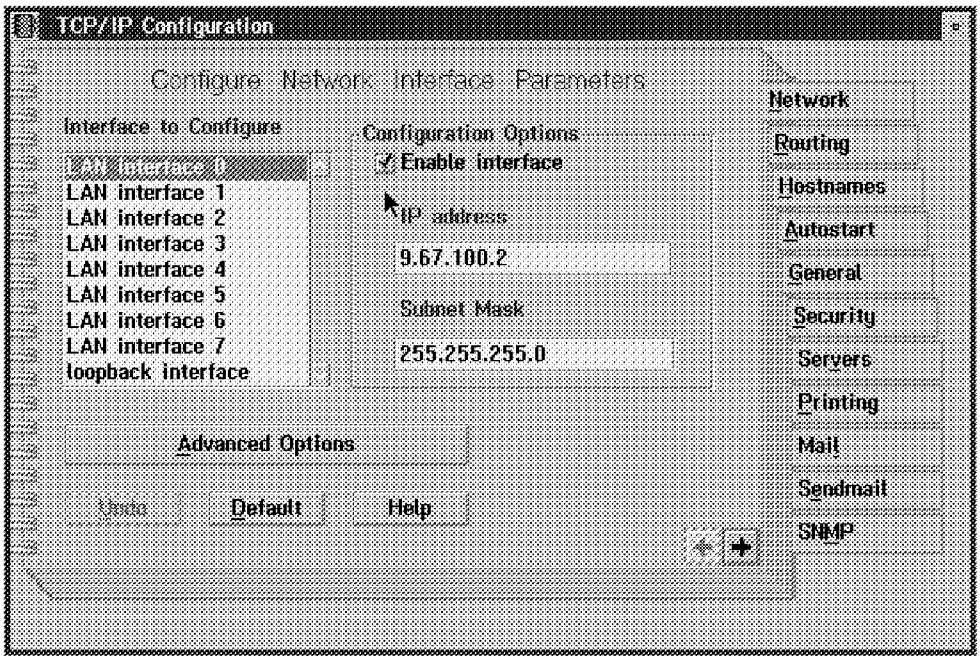


Figure 46. TCP/IP Configuration - Network (TCP/IP Workstation)

- For your address mappings, add the following entries to the \etc\hosts file:

```
9.67.100.15 WTR05159.USIBMRA.SNA.IBM.COM
9.67.100.7  A2217.USIBMRA.SNA.IBM.COM
9.67.100.7  WTR05216.USIBMRA.SNA.IBM.COM
9.67.100.7  WTR05217.USIBMRA.SNA.IBM.COM
```

3.2.1.5 Workstation Y Configuration

The configuration of workstation Y is similar to the configuration of workstation X.

- Specify 9.67.100.15 as the IP address interface.
- For your address mappings, add the following entries to the \etc\hosts file:

```
9.67.100.2  WTR05158.USIBMRA.SNA.IBM.COM
9.67.100.7  A2217.USIBMRA.SNA.IBM.COM
9.67.100.7  WTR05216.USIBMRA.SNA.IBM.COM
9.67.100.7  WTR05217.USIBMRA.SNA.IBM.COM
```

Note

If you have TCP/IP and MPTS installed in your workstation, use the \etc\hosts file pointed by the etc environment variable.

3.3 Sample Scenario 2: Using Multiple SNA over TCP/IP Gateways

You can also install multiple IBM 2217 Nways MpC Release 2.0 using SNA over TCP/IP Gateways. When configured to support SNA over TCP/IP, an IBM 2217 MpC connects a TCP/IP network to an SNA network. In this section, we configure the following scenario where two TCP/IP networks (9.24.104 and 192.168.221) are connected to an SNA backbone. The objective here is to be able to run APPC and CPI-C applications in all workstations whether they are TCP/IP or SNA connected.

3.3.1 Configuration

The configuration of an IBM 2217 MpC SNA over TCP/IP Gateway in this case is similar to the way you configure a simple SNA over TCP/IP Gateway. However, in this case you must change the default CP and Connection Network names. Failing to change these names will cause name conflicts in your configuration. The SNA over TCP/IP Gateway function acts as an LEN node on behalf of the CPs and LUs connected to its TCP/IP network. Next, we show you the configuration of the SNA over TCP/IP function in the IBM 2217 MpC.

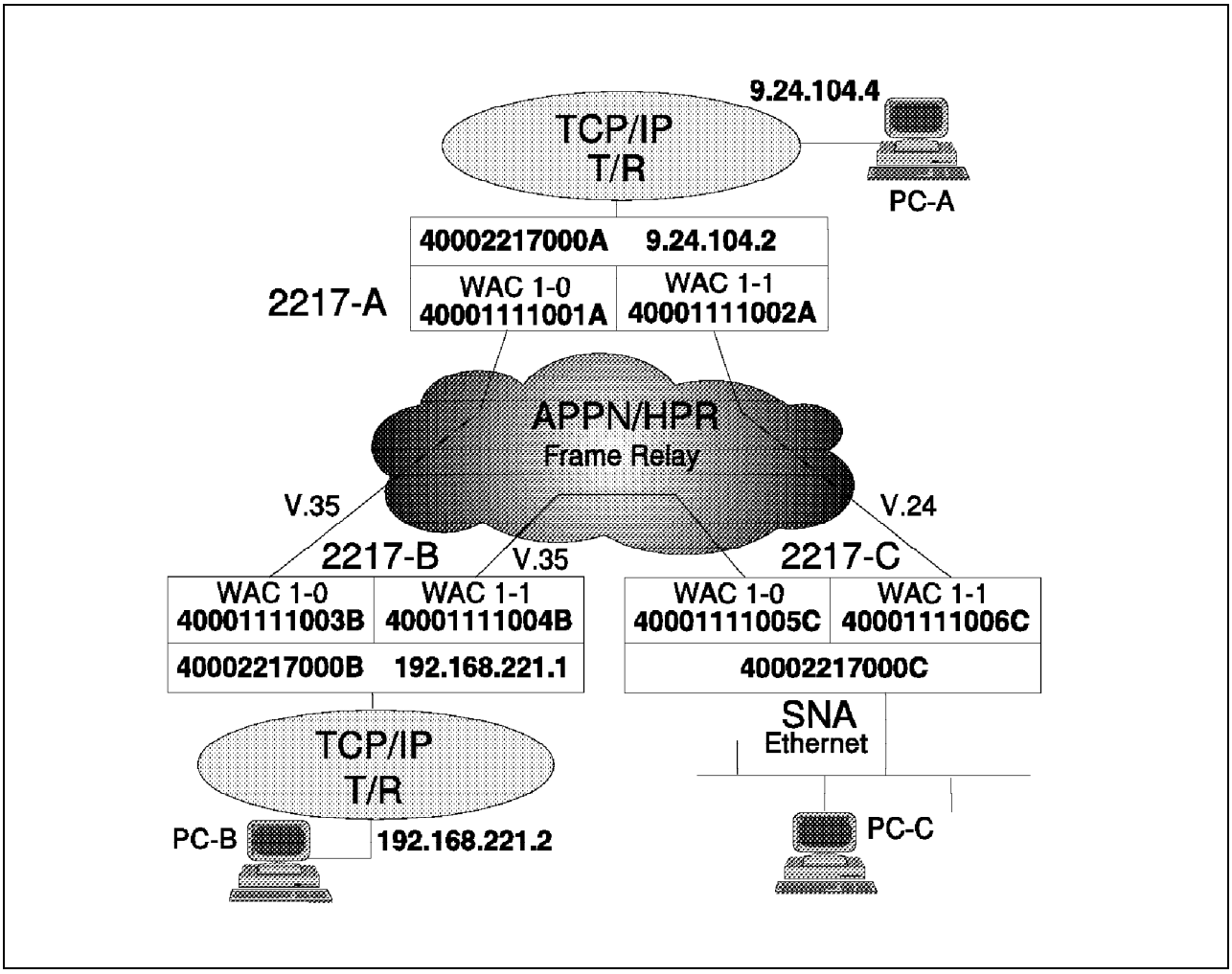


Figure 47. Multiple IBM 2217 MpC SNA over TCP/IP Gateways Configuration

3.3.2 Definitions in 2217-A

The main objective here is to configure 2217-A as an SNA over TCP/IP Gateway. 2217-A connects TCP/IP network 9.24.104 to the SNA over frame relay network. In 2217-A, you must configure at least the following profiles:

1. LAN Adapter (T/R)
2. WAN Adapter (frame relay)
3. SNA local node
4. LAN Protocol Configuration - SNA over IP Gateway
5. LAN Protocol Configuration - TCP/IP

3.3.2.1 LAN Adapter (T/R) Configuration

In the LAN Adapter Configuration panel, enter the T/R address 40002217000A. For more details on how to configure the LAN Adapter please see Chapter 2, “SNA Enhancements” on page 19.

3.3.2.2 Frame Relay General Parameters

In the frame relay parameters (General), enter the MAC address 40001111001A and default ring number 151. For more details on how to configure the frame relay parameters, please see Chapter 2, “SNA Enhancements” on page 19.

3.3.2.3 SNA Local Node

IBM 2217 MpC 2217-A must be defined as a network node in order to be used as an SNA over TCP/IP gateway.

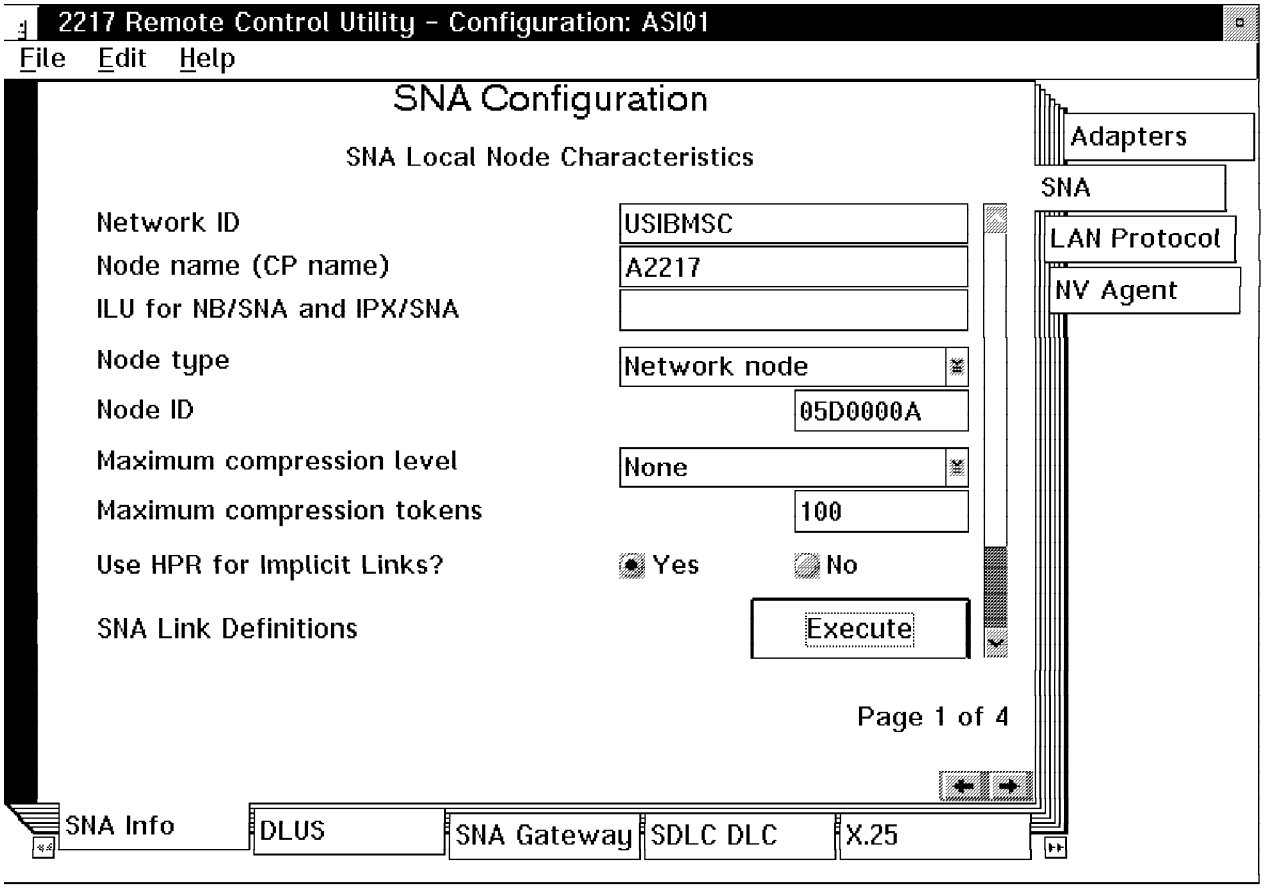


Figure 48. Local Node Characteristics (2217-A)

3.3.2.4 SNA over TCP/IP Gateway Configuration

In this scenario, we use the default value for the SNA domain name suffix, which is SNA.IBM.COM. However, the suffix that you specify in this configuration panel must be the same value you specify in your address mappings in your hosts file or domain name server. Default values are also used for the other parameters.

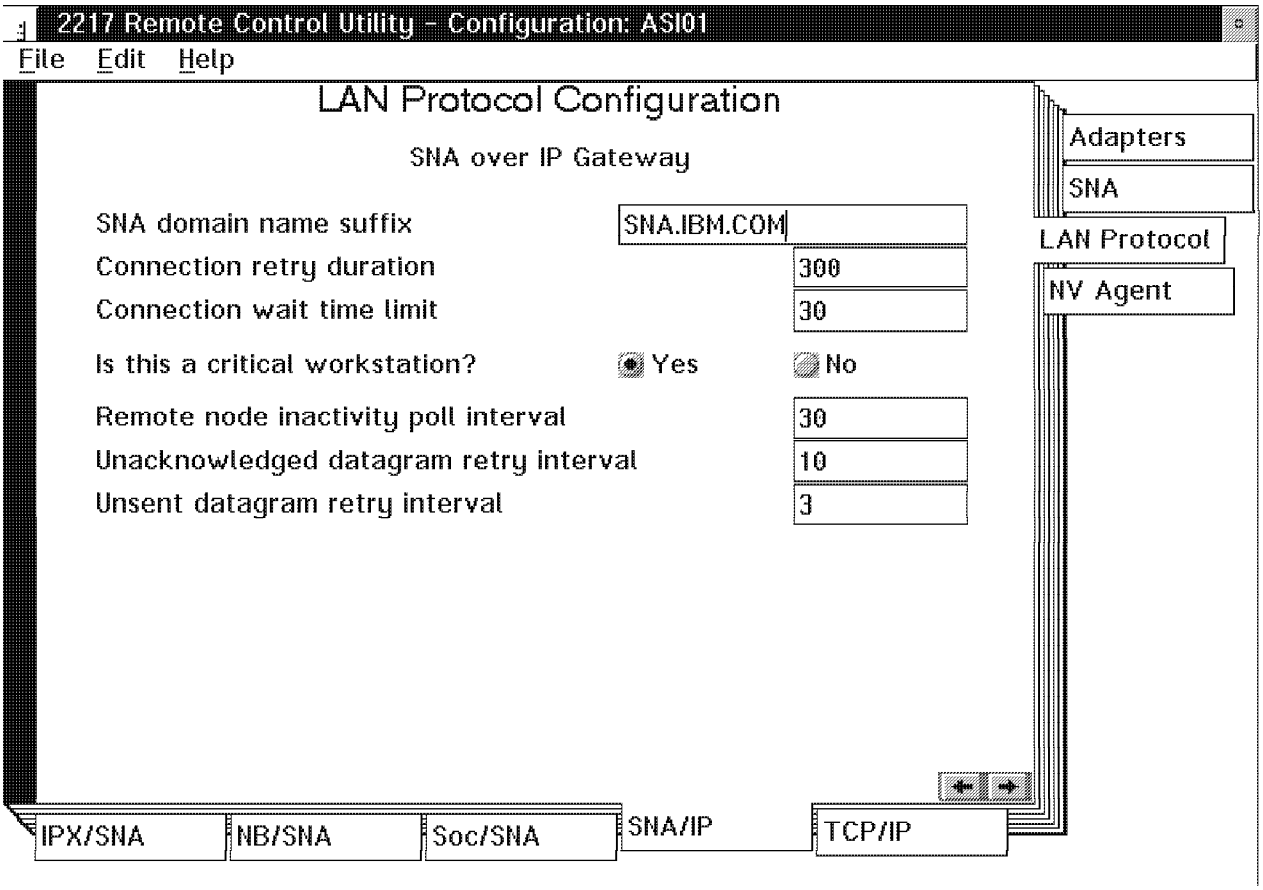


Figure 49. SNA over TCP/IP Gateway Configuration

3.3.2.5 TCP/IP Configuration

The SNA over TCP/IP Gateway (2217-A) uses TCP/IP, and therefore, you must configure TCP/IP. Enter the IP address interface 9.24.104.2 as follows:

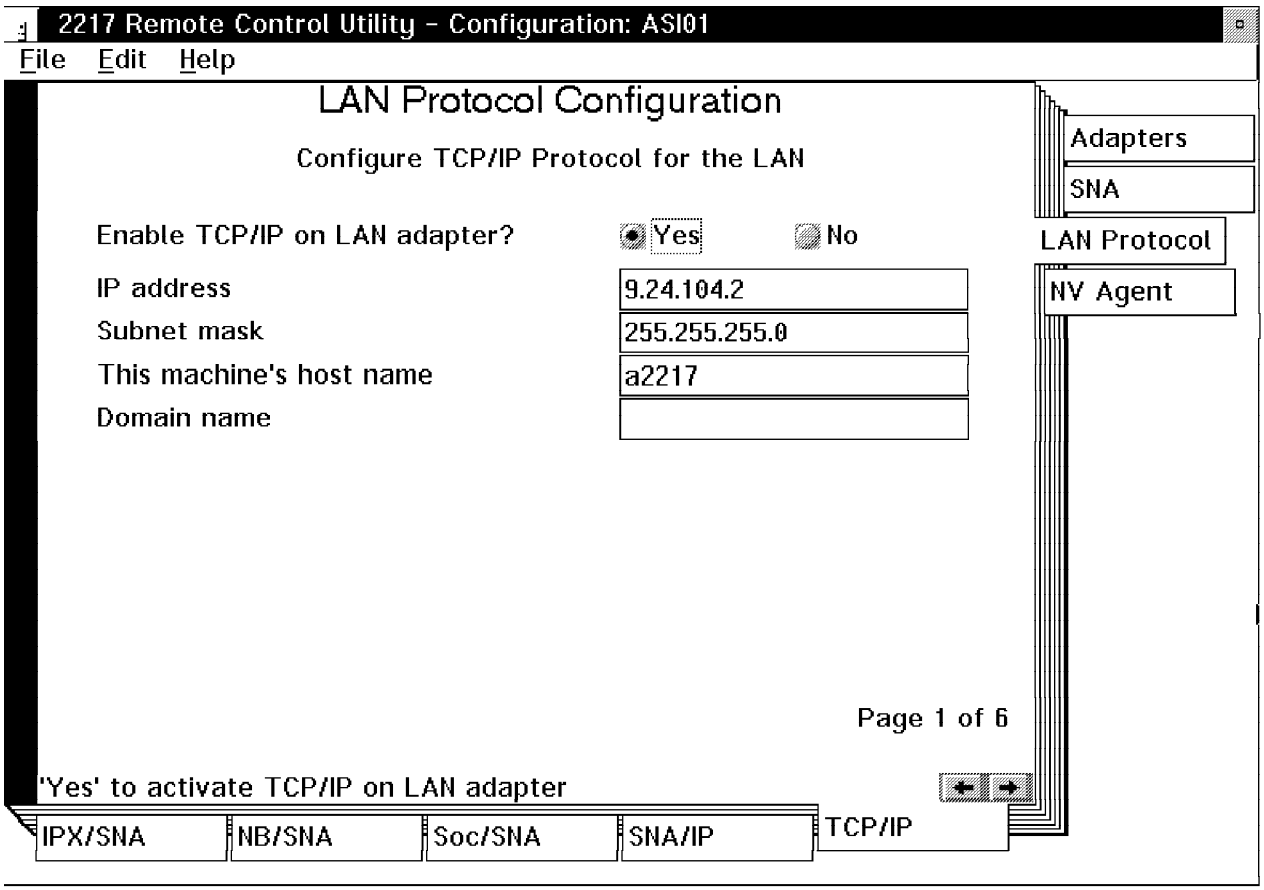


Figure 50. TCP/IP Configuration (2217-A)

3.3.2.6 Hosts File in 2217-A

When you want to use the 2217-A as an SNA over TCP/IP Gateway, you must define your address mappings using either a hosts file or a domain name server. In this configuration, we have workstation PC-A, which TCP/IP connected, and therefore we define the host name cppca.usibmsc.sna.ibm.com to its IP address 9.24.104.4.

Because we are using multiple SNA over TCP/IP Gateways, we are also required to provide unique names for their CP name and connection network.

The defaults values for the CP and connection network names for the IBM 2217 MpC SNA over TCP/IP Gateway are:

- Default CP name = $ANYNET.$GWCP
- Default connection network name = $ANYNET.$GWCNET

To change the default names, include the following entries in your hosts file or domain name server (DNS) where ipneta.cpa and ipneta.cneta must be unique names in your network:

- 127.0.0.3 ipneta.cpa
- 127.0.0.4 ipneta.cneta

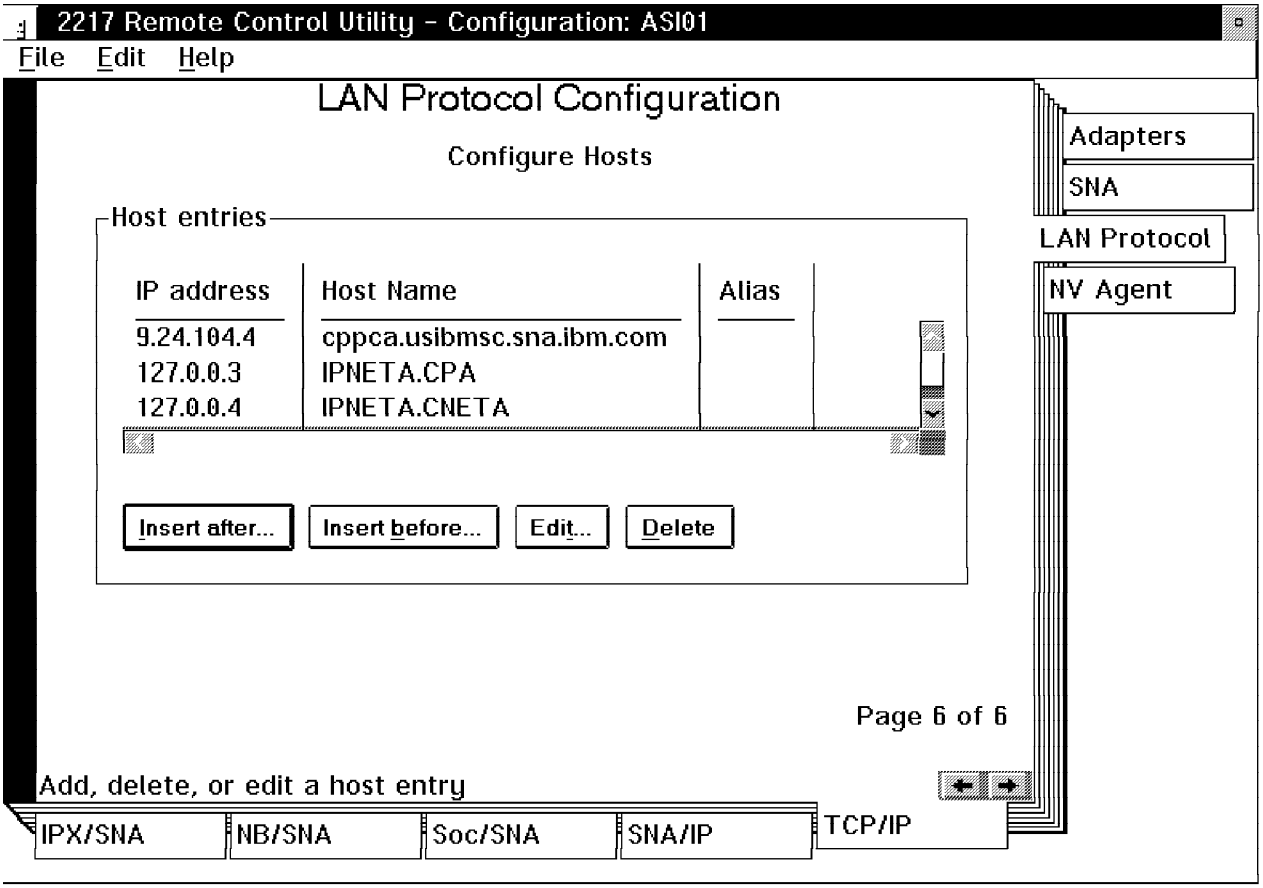


Figure 51. Hosts Local File of 2217-A

In order to verify that in fact you have changed the default values, you may want to display the connection network using the RCU as follows:

```
************************************
*   Connection Network Information   *
************************************
Connection network definitions            1

1>Connection network name                  IPNETA.CNETA
  Effective capacity                      3000000 bits per second
  Cost per connect time                   254
  Cost per byte                          254
  Propagation delay                       9.22 milliseconds (telephone)
  User defined parameter 1                128
  User defined parameter 2                128
  User defined parameter 3                128
  Security                               Nonsecure
  Attached adapters                       0
```

Figure 52. SNA over TCP/IP Connection Network Display

3.3.3 Definitions in 2217-B

The main objective here is to configure 2217-B as an SNA over TCP/IP Gateway. 2217-B connects TCP/IP network 192.168.221 to the SNA over frame relay network. In 2217-B, you must configure at least the following profiles:

1. LAN Adapter (T/R)
2. WAN Adapter (frame relay)
3. SNA local node
4. LAN Protocol Configuration - SNA over IP Gateway
5. LAN Protocol Configuration - TCP/IP

3.3.3.1 LAN Adapter (T/R) Configuration

In the LAN Adapter Configuration panel, enter the T/R address 40002217000B. For more details on how to configure the LAN Adapter please see Chapter 2, “SNA Enhancements” on page 19.

3.3.3.2 Frame Relay General Parameters

In the frame relay parameters (General), enter the MAC address 40001111003B and default ring number 151. For more details on how to configure the frame relay parameters, please see Chapter 2, “SNA Enhancements” on page 19.

3.3.3.3 SNA Local Node

IBM 2217 MpC 2217-B must be defined as a network node in order to be used as an SNA over TCP/IP Gateway. For more details on how to configure the local node in 2217-B, please see Chapter 2, “SNA Enhancements” on page 19.

3.3.3.4 SNA over TCP/IP Gateway Configuration

In this scenario, we use the default value for the SNA domain name suffix, which is SNA.IBM.COM. However, the suffix that you specify in this configuration panel must be the same value you specify in your address mappings in your hosts file or domain name server. Default values are also used for the other parameters.

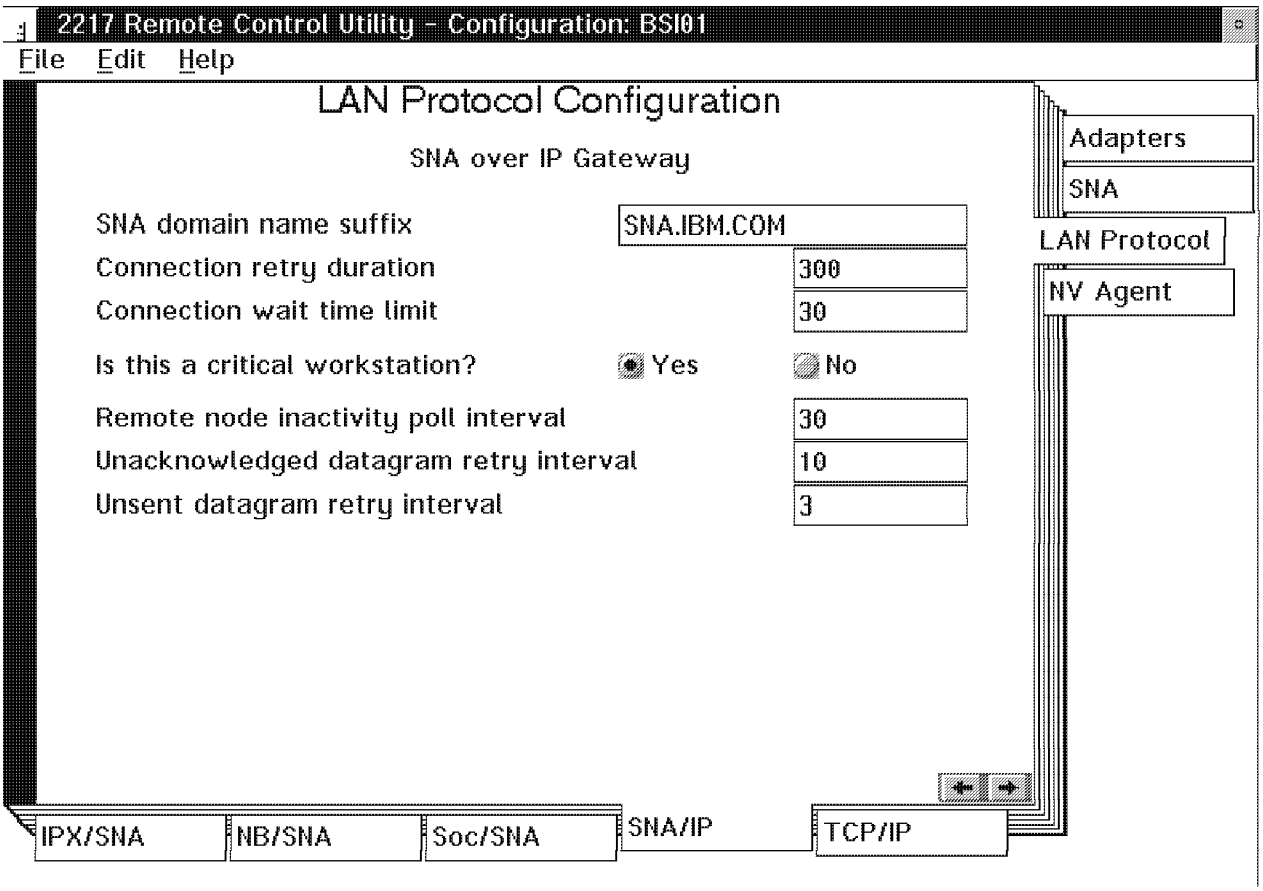


Figure 53. SNA over TCP/IP Configuration (2217-B)

3.3.3.5 TCP/IP Configuration

In TCP/IP you need to configure the address interface and your address mappings. Because the configuration includes multiple SNA over TCP/IP Gateways, you also need to change the CP name and connection network name for the specified gateway.

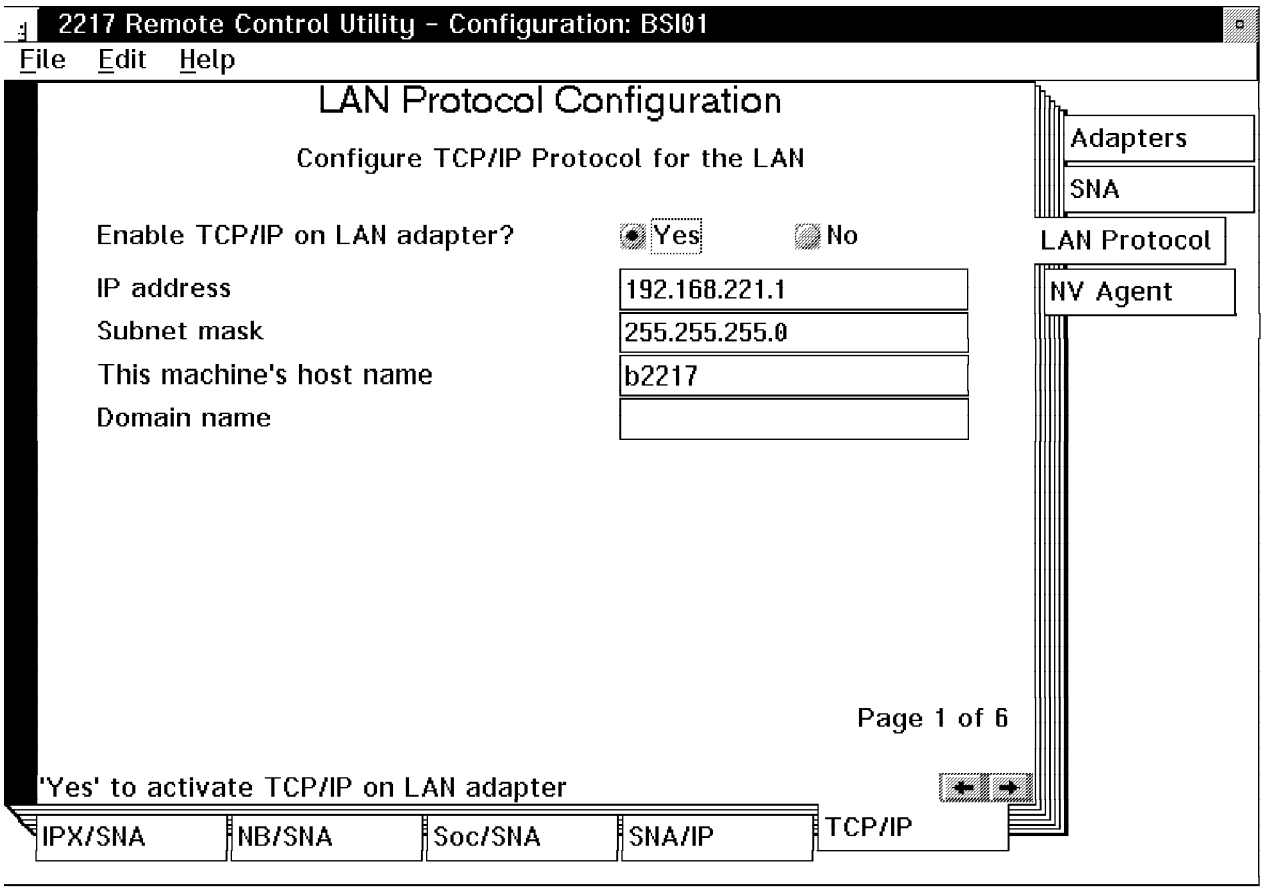


Figure 54. TCP/IP Configuration (2217-B)

3.3.3.6 Hosts File in 2217-B

Similar to the 2217-A, you configure your address mappings and change the default names in the 2217-B SNA over TCP/IP Gateway in order to have a unique name and avoid conflicts in your network.

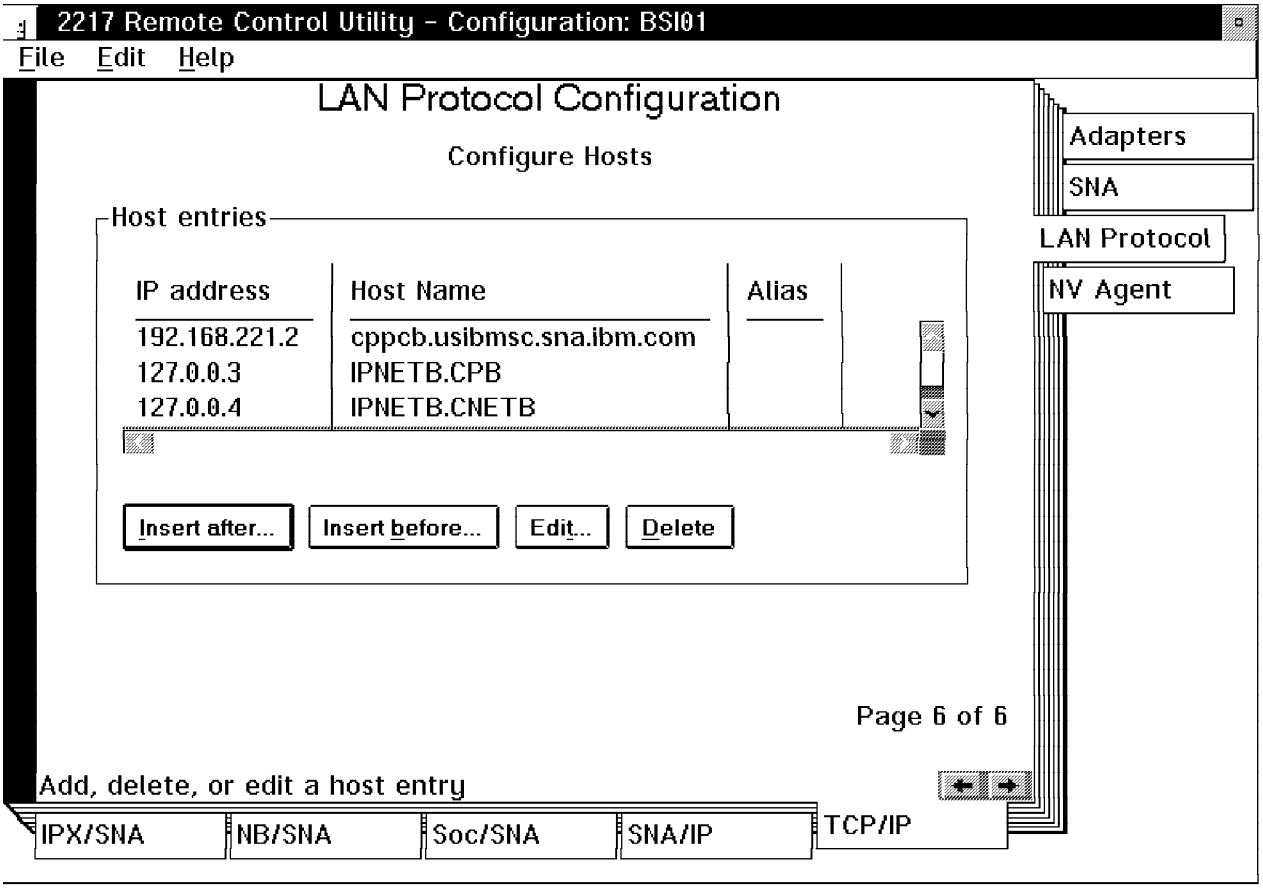


Figure 55. Hosts File in 2217-B SNA/IP Gateway

```
************************************
*   Connection Network Information   *
************************************
Connection network definitions             1

1>Connection network name                  IPNETB.CNETB
  Effective capacity                      3000000 bits per second
  Cost per connect time                    254
  Cost per byte                           254
  Propagation delay                        9.22 milliseconds (telephone)
  User defined parameter 1                 128
  User defined parameter 2                 128
  User defined parameter 3                 128
  Security                                Nonsecure
  Attached adapters                        0
```

Figure 56. SNA over TCP/IP Connection Network Display

3.3.4 OS/2 Workstation Configuration

The OS/2 workstations that are connected to the TCP/IP network require either Communications Server 4.0 or its client component called the OS/2 Access Feature. A minimum configuration is required in order to provide SNA over TCP/IP access support.

You must at least define:

- Local Node. A local node name is always required.
- AnyNet base parameters. This definition will enable the SNA over TCP/IP function.
- Transaction Program definitions. These are only required when you want to execute APPC or CPI-C server programs in your OS/2 workstation. For example, APINGD which is the server TP of the APING client program.

Note

Because the OS/2 workstation is connected to a TCP/IP network, you must install and configure TCP/IP also.

3.3.4.1 Workstation Local Node

The OS/2 workstation is defined as an end node (EN).

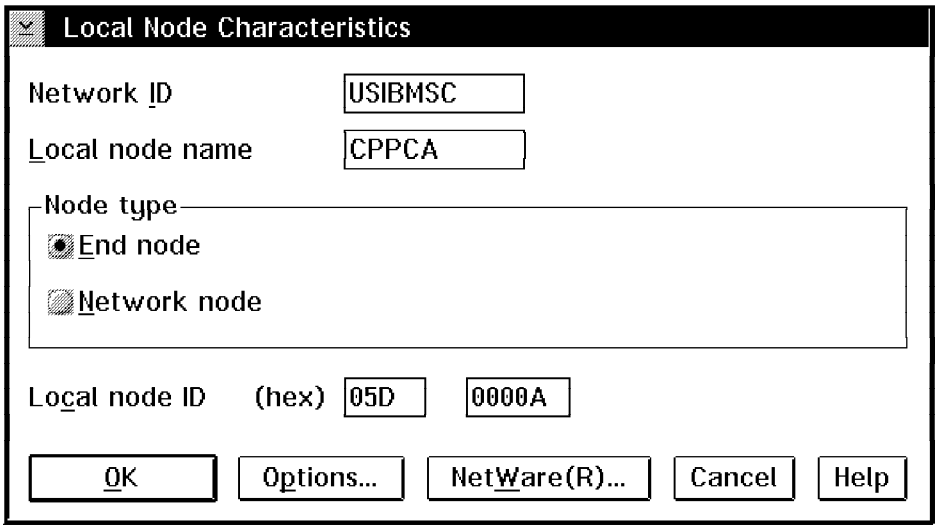


Figure 57. Local Node Characteristics for PC-A

3.3.4.2 Selecting SNA over TCP/IP Access

In order for your OS/2 workstation to support SNA over TCP/IP, you must select and configure the AnyNet Parameters. In this configuration, we use default values with a default routing preference as Non-native only (TCP/IP only).

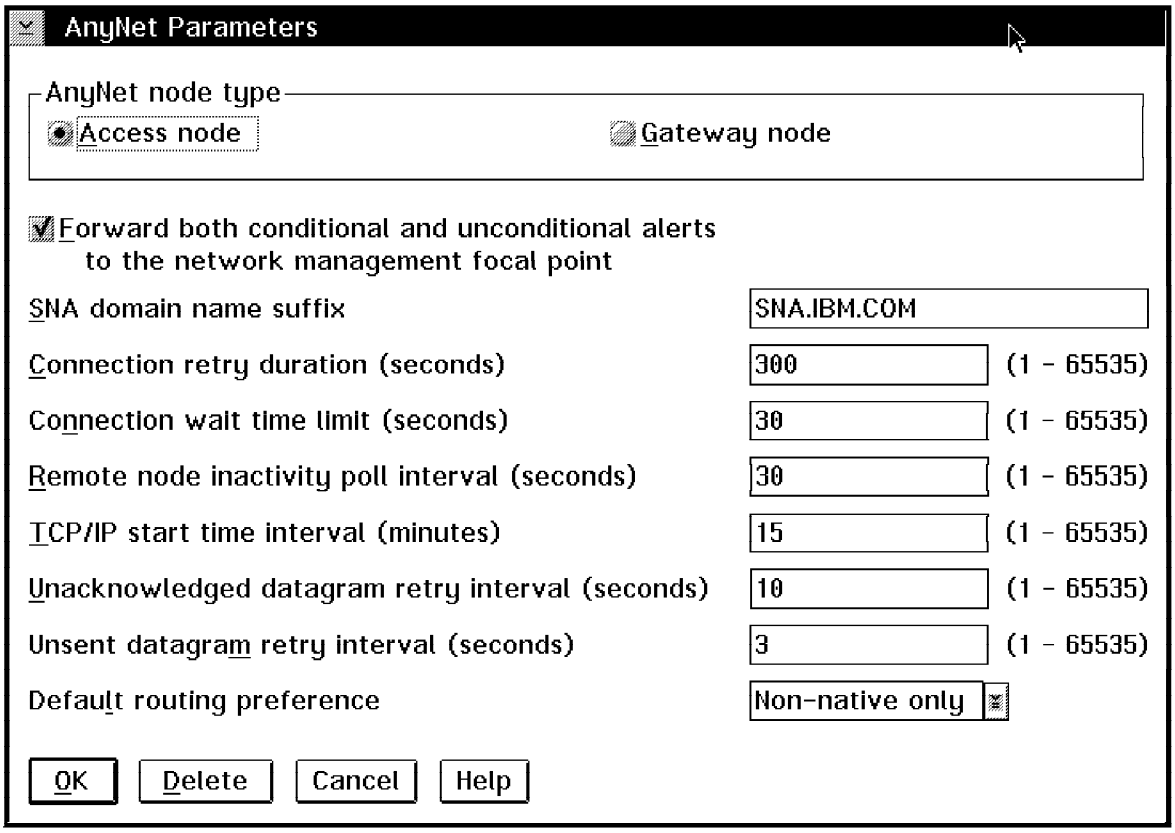


Figure 58. Anynet Base Parameter Settings

3.3.4.3 TCP/IP Configuration in PC-A

The following are IP addresses in PC-A:

```
lan0: flags=3c63<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
     inet 9.24.104.4 netmask ffffff00x broadcast 9.24.104.255
```

3.3.4.4 Address Mappings in PC-A

You can either use a domain name server (DNS) or a hosts file for your SNA over TCP/IP address mappings. In this scenario, we use a hosts file.

In this file, you are basically indicating the IP address of the IBM 2217 Nways MpC Release 2.0 (9.24.104.2) that provides the SNA over TCP/IP Gateway. For example:

```
9.24.104.2 CPPCB.USIBMSC.SNA.IBM.COM
9.24.104.2 A2217.USIBMSC.SNA.IBM.COM
9.24.104.2 B2217.USIBMSC.SNA.IBM.COM
```

Note

If you decide to use a domain name server (DNS), a wildcard can be used and therefore fewer entries are required (for example, *.USIBMSC.SNA.IBM.COM 9.24.104.2).

3.3.4.5 TCP/IP Configuration in PC-B

The following are IP addresses in PC-B:

```
lan0: flags=3c63<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
     inet 192.168.221.2 netmask ffffff00 broadcast 192.168.221.255
```

3.3.4.6 Address Mappings in PC-B

In a similar way, you configure your address mapping using a hosts file in PC-B. The IP address of SNA over TCP/IP Gateway is 192.168.221.1 in this case.

```
192.168.221.1 CPPCA.USIBMSC.SNA.IBM.COM
192.168.221.1 B2217.USIBMSC.SNA.IBM.COM
192.168.221.1 A2217.USIBMSC.SNA.IBM.COM
```

3.3.4.7 Defining Server Transaction Programs

You must define any server programs you need to execute in your workstation.

Note

TP names are case sensitive in OS/2 Communications Server.

For example, APINGD is defined in order to execute and APING the OS/2 workstation from other nodes.

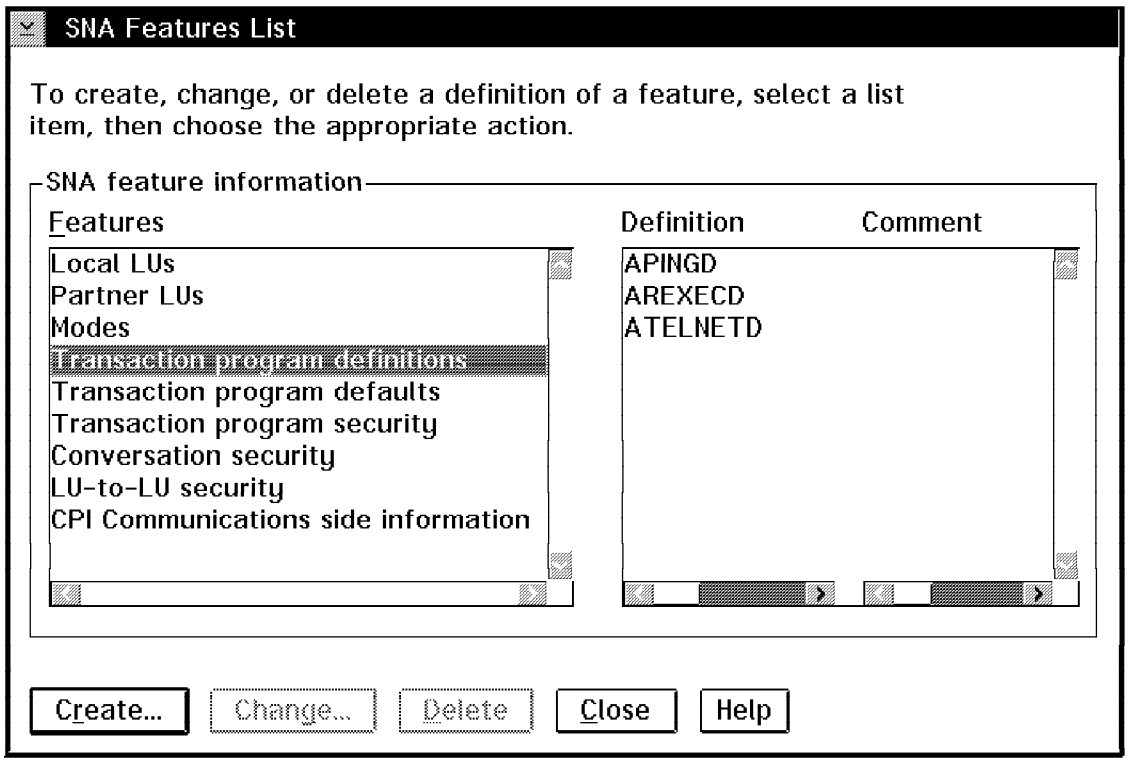


Figure 59. Transaction Program List

3.4 Troubleshooting Problems

Diagnostic information is recorded in the error log files. Some SNA over TCP/IP error messages generate either conditional or unconditional alerts.

In general, when having problems, you should try to isolate the failure by doing the following:

- Review your address mappings.
- Use PING to test your IP connections.
- Use APING to test your SNA connections.
- APING the IBM 2217 MpC SNA over TCP/IP Gateway.
- From TCP/IP connected nodes, APING the SNA connected nodes.
- From SNA connected nodes, APING the TCP/IP connected nodes.
- Display your logical links.
- Run traces and look for sense codes that might point to the problem you are having.

Chapter 4. SNA Gateway for Dependent LU Sessions

The IBM 2217 Nways MpC Release 2.0 SNA Gateway has been enhanced to take advantage of the SNA and APPN extensions. In this chapter, we describe the enhancements included in the new IBM 2217 Nways MpC Release 2.0 SNA Gateway, which are the following:

- Dependent LU requester support for downstream workstations
- Dedicated PU (NetView Visibility of downstream workstation PUs)

There are other enhancements to IBM 2217 Nways MpC Release 2.0 that indirectly affect the SNA Gateway component, such as:

- SDLC full-duplex support
- SDLC multipoint primary support

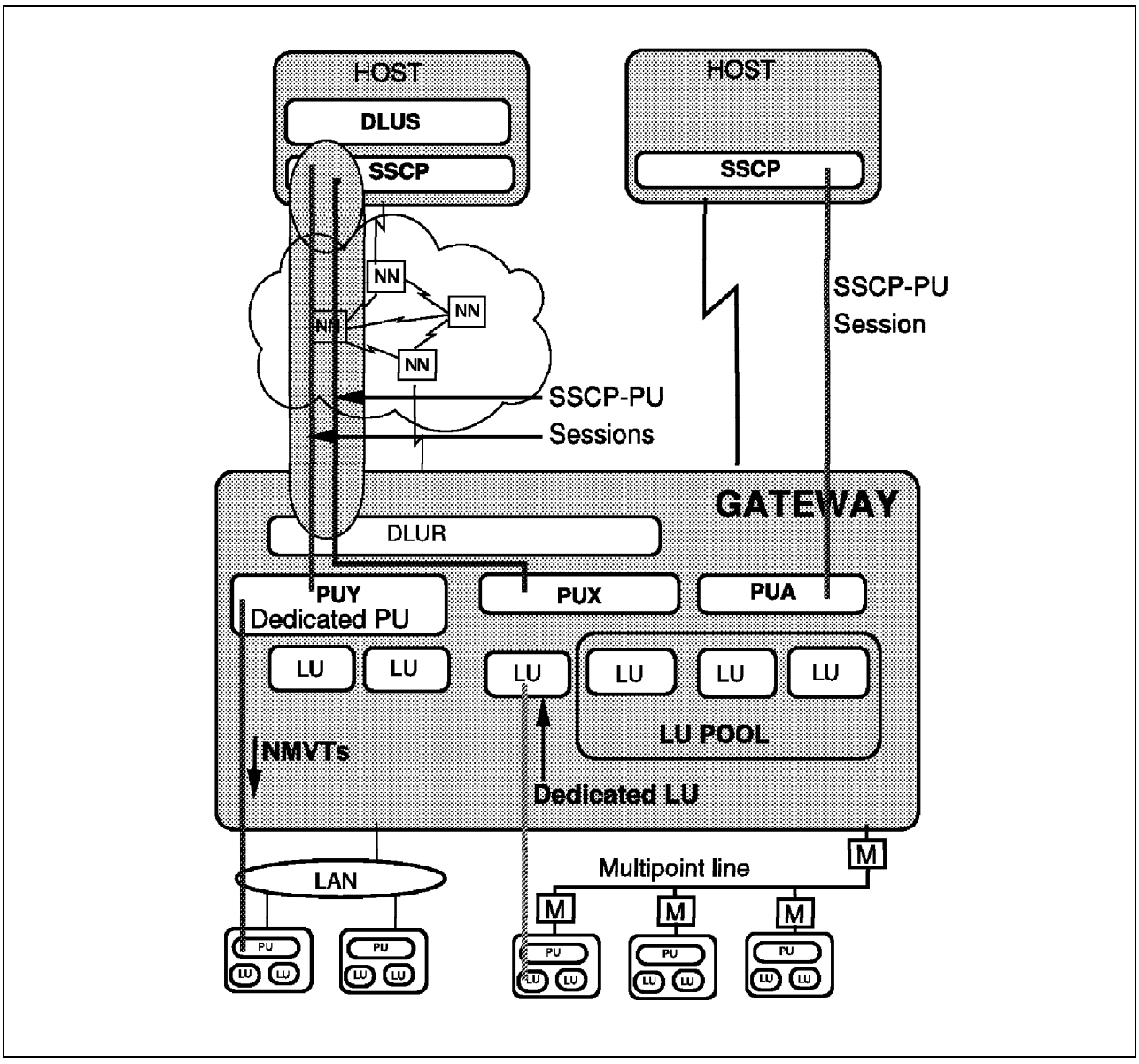


Figure 60. SNA Gateway Enhancements

4.1 Dependent LU Requester Support in SNA Gateway

As an SNA Gateway, IBM 2217 Nways MpC Release 2.0 provides dependent LU requester (DLUR) support for the downstream workstations that are using the services of a gateway for host access of application to application (LU0), 3270 (LU2) and host printing applications (LU1 and LU3). The gateway depends upon a VTAM system to provide the dependent LU server (DLUS) portion of the client to server relationship (see Figure 61).

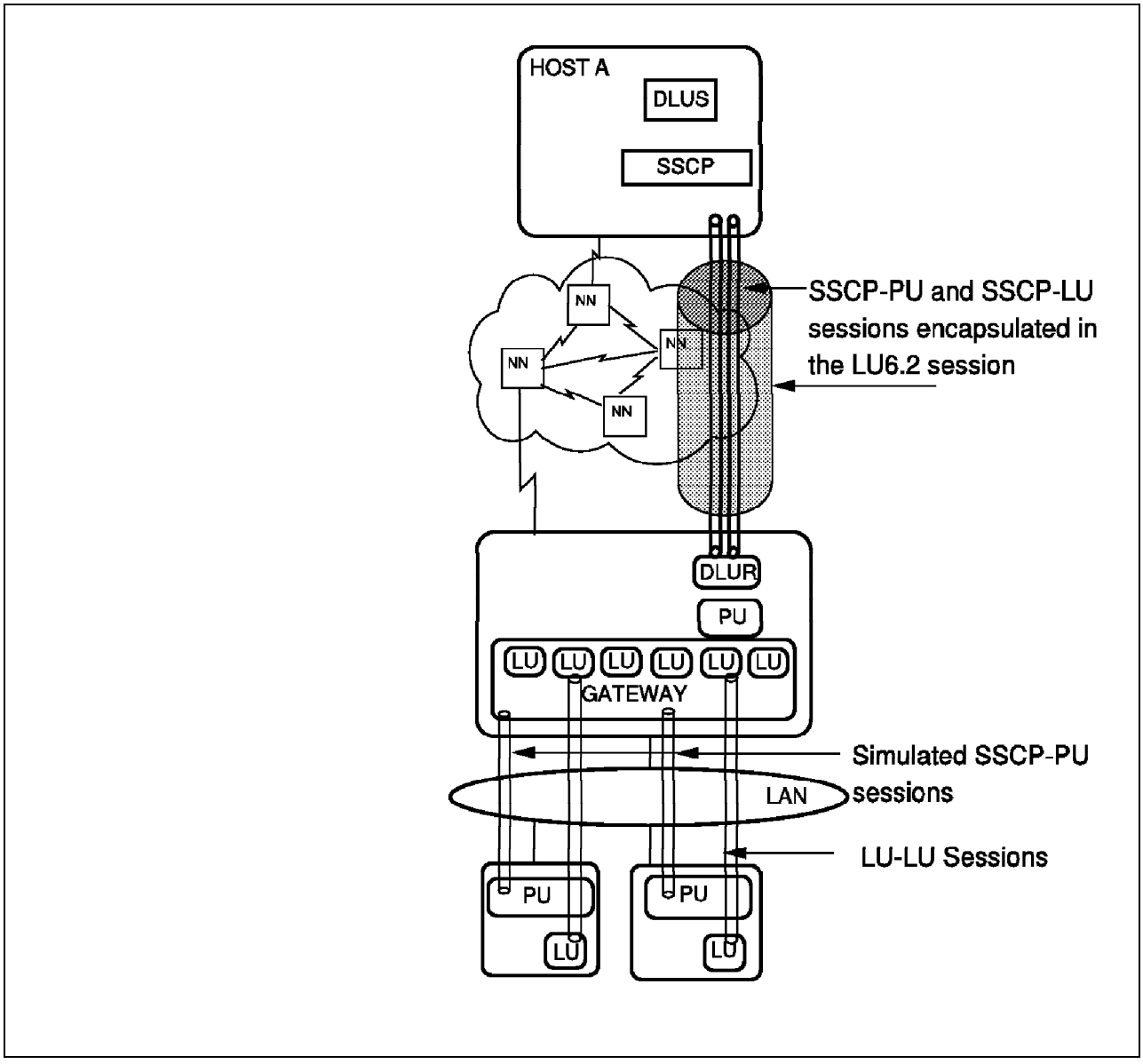


Figure 61. Use of DLUR in an IBM 2217 MpC SNA Gateway

This IBM 2217 Nways MpC Release 2.0 dependent LU requester (DLUR) SNA Gateway can be directly (adjacent) or indirectly (non-adjacent) connected to a mainframe. A gateway machine, which is directly attached to an NCP, may not have much advantage in using DLUR/DLUS; however, if the gateway machine is located on one or more levels down into an APPN network, it can then take advantage of DLUR/DLUS to deliver dependent LU support to downstream workstations.

4.1.1.1 Accessing a Dependent LU Server

DLUR is a means of attaching downstream dependent devices through APPN. It provides the downstream devices with the enhanced SSCP support provided by VTAM's dependent LU server (DLUS) function, which was introduced with VTAM 4.2. This allows resources to be able to connect to a host without having to be in the same domain. The DLUR and DLUS nodes don't have to be in adjacent subnetworks.

The control flows (SSCP-PU and SSCP-LU) are encapsulated within APPC sessions (one pair per DLUR). This session is using a new mode, CPSVRMGR, and is called an LU 6.2 or CP-SVR pipe. All SSCP-PU and SSCP-LU flows are encapsulated on this pipe between the DLUS and the DLUR. However, the LU-LU session is native and flows independent of the LU 6.2 session. The BIND request, which flows to establish the LU-LU session, is not encapsulated on this pipe. This pipe will be defined as the host link for the PUs and LUs.

The LU-LU sessions are associated with an LFSID (local form session identifier) which will be mapped to the LU names contained in the BIND request. The BIND request has been extended to also contain the APPN routing information (RSCVs) which makes the necessity of an SSCP obsolete. The SSCP-LU session must exist before any LU-LU session can be established. However, once the LU-LU session is up it may stay up even when the SSCP-PU or SSCP-LU session is terminated.

4.1.1.2 DLUR and APPN/HPR

DLUR can exploit HPR connectivity to support non-disruptive sessions. If a link fails, the end user does not see any outage as long as the link recovers in a COS specified time, and if an alternate link is available sessions can switch to it with no disruption.

Combining DLUR with HPR will enable any portion of the session that fails to be recovered, not being limited only to failures of the WAN links.

4.1.1.3 DLUR Flows

As far as the gateway is concerned, it is operating just as if it were directly adjacent to an NCP. The downstream workstations are also not aware of the difference. Traditional SNA flows of ACTPU to start the SSCP-PU session and ACTLU to start the SSCP-LU sessions must still flow prior to the BIND to start the LU-LU session. This difference is that the SSCP-PU session and SSCP-LU sessions between the gateway (dependent LU requester (DLUR)) and VTAM (dependent LU server (DLUS)) are encapsulated in LU 6.2 sessions to take advantage of APPN routing. However, LU-LU sessions are not encapsulated and they flow native in an APPN network.

There is potentially one advantage of using DLUR for a gateway that is directly attached to an NCP, and that is the ability to support multiple PUs over a single physical link to the subarea.

Another advantage of using DLUR is the ability to optimize LU-LU session flows by bypassing the VTAM/NCP boundary function when routing traffic directly from the DLUR node (boundary function) to the destination LU.

If there is a need for more than 255 LUs in a SNA gateway, use multiple PUs; to use multiple PUs, there is a need for more than one link.

To define more than one link to the same destination host, one might need to use more than one adapter on the IBM 2217 MpC or have a communications controller that has more than one adapter in order to provide a different destination address.

All of this can be simplified by using DLUR/DLUS, which will allow the use of multiple PUs using the same physical connection to one host.

4.2 Dedicated PUs

The IBM 2217 Nways MpC Release 2.0 has included support for the passthrough PU or dedicated PU support. Multiple upstream PUs can be associated, one-to-one, to downstream PUs. This feature allows the host system to view the downstream PU connected to the IBM 2217 MpC SNA Gateway and, therefore, be able to send and receive messages over the SSCP-PU control session such as commands and alerts.

4.2.1 NMVTs and the Gateway

Next, we examine the flow of NMVTs on the SSCP-PU sessions in the case of DLUR/DLUS and the IBM 2217 MpC SNA Gateway, but first let's start by looking at the flow on NMVTs in a traditional gateway (that is, without the current enhancements).

If a node is directly attached to a subarea through the NCP boundary function, its PU is defined in VTAM and is visible to VTAM. Therefore, any data sent on the SSCP-PU session with the PU as a destination will reach the PU.

NetView operators can therefore send any data to these PUs. Similarly, any unsolicited management data, such as alerts, can reach the host focal point (NetView) by being sent upstream on the SSCP-PU session.

However, in the case of nodes located downstream of a gateway, these nodes are not defined in VTAM and are, therefore, not visible to VTAM. The consequence is that management data, such as RUNCMDs, cannot be sent to these downstream PUs.

The reason for that is that there are no fields in an NMVT that identify the source and destination of it (such as what you find in the more modern MDS-MU GDS variable). That means that when the gateway examines data received on its SSCP-PU session, it does not know the destination of the data.

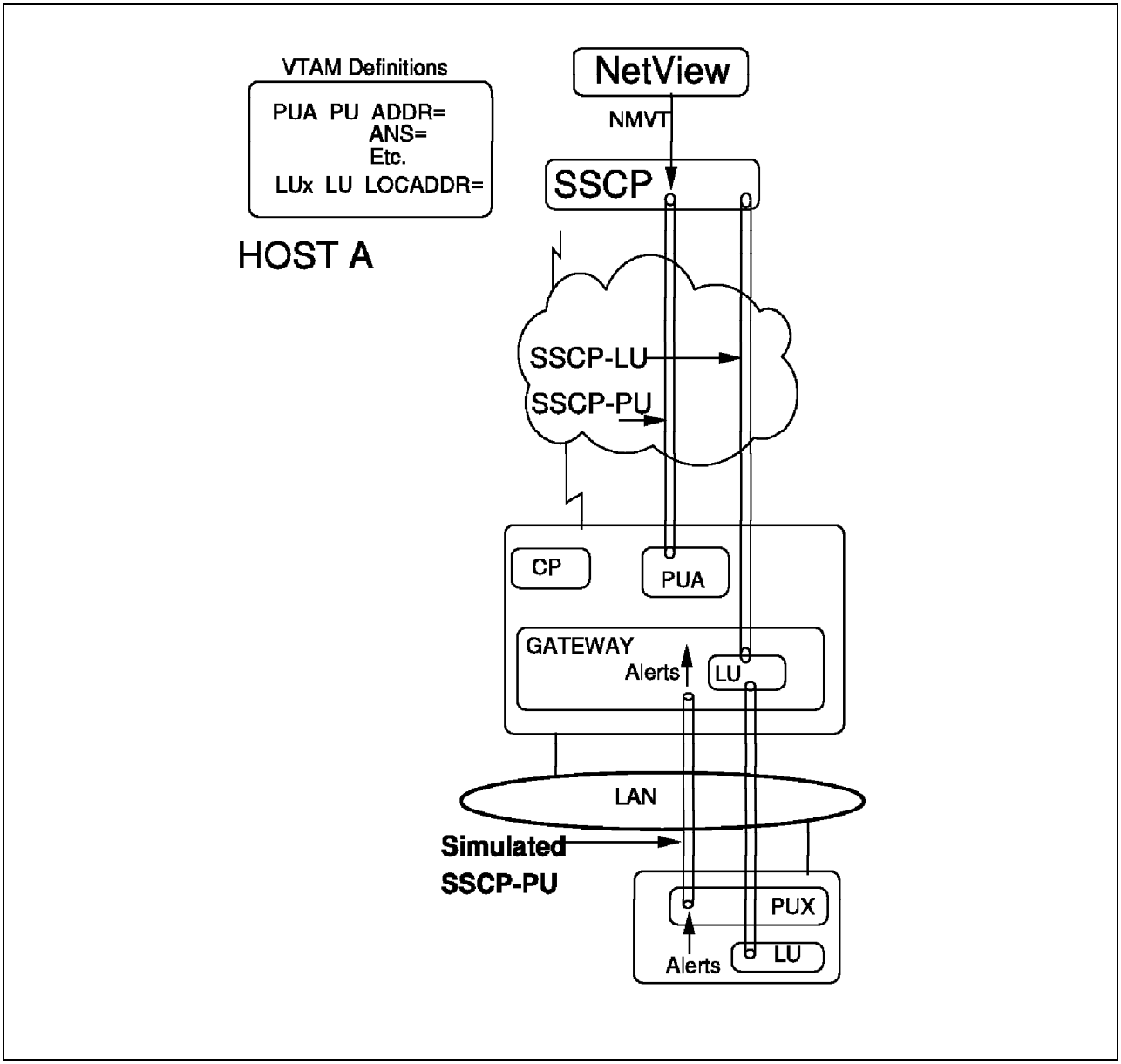


Figure 62. NVMTs and the Gateway

With DLUR/DLUS, despite the fact that a workstation is not directly attached to a subarea, it does have an SSCP-PU session with an SSCP through the use of an LU 6.2 session; therefore, it can send or receive NMVTs on the SSCP-PU session, just as if it were directly attached to the subarea.

In other words, to the workstation, the situation appears exactly as if it were directly attached. Note that there is a PU definition in VTAM, and this PU is visible and addressable by VTAM. The benefit is that NetView commands can be issued in the normal fashion.

4.2.2 Downstream PU (DSPU) Support

In IBM 2217 Nways MpC Release 2.0, the capability to send NMVTs (or for that matter any data that flows on the SSCP-PU session) to nodes downstream of a workstation has been added.

Other names for this function are Downstream PU Visibility or Passthrough Function or NetView Awareness Feature or Dedicated Gateway PU. We added this to make you aware that there are several names for it, so you would not be confused by the different names. In this book, we simply call it Downstream PU Support.

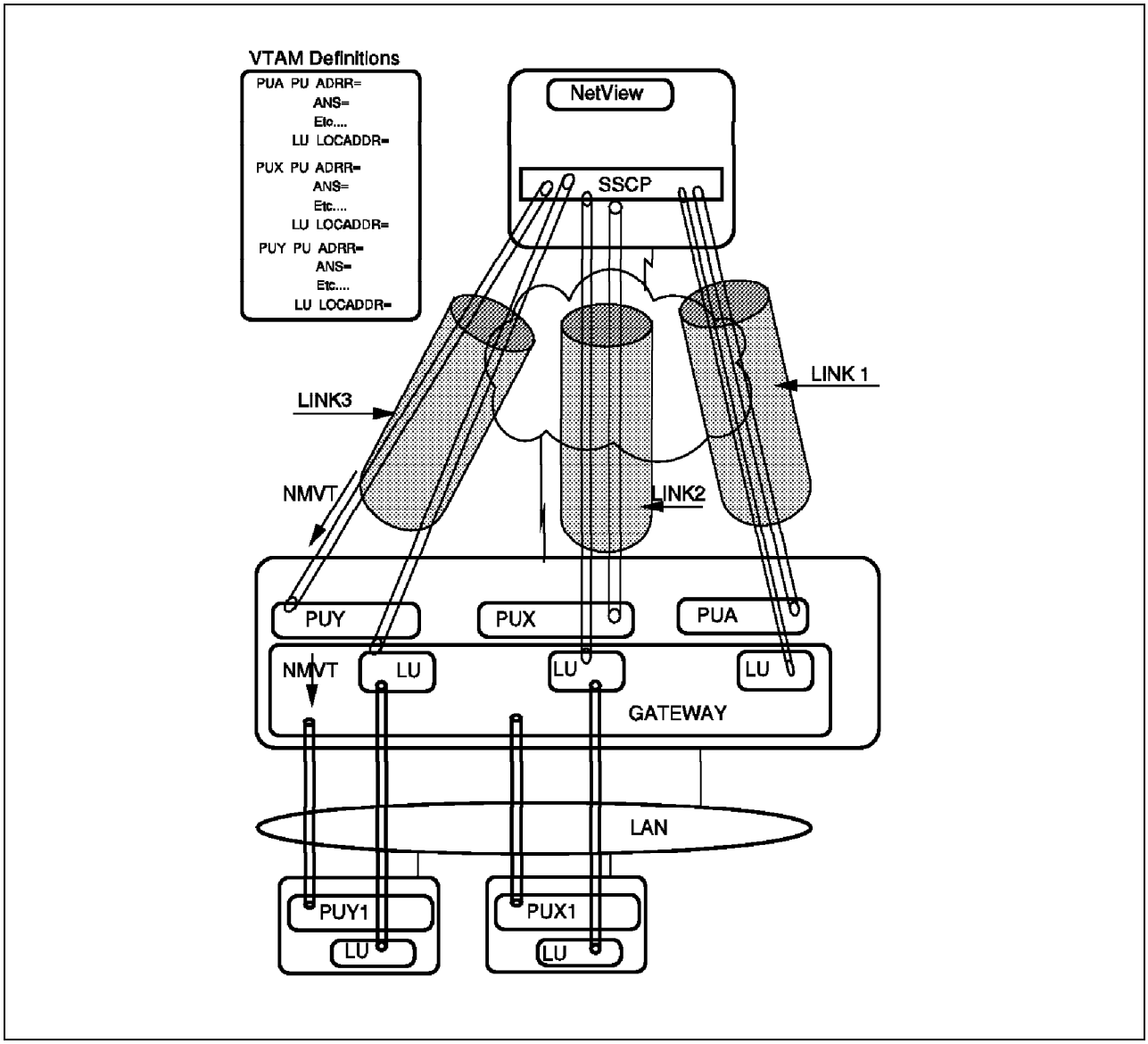


Figure 63. Dedicated Gateway PU

Downstream PU Support has been implemented by taking advantage of the existing multiple PU support and by defining additional PUs in the gateway at the rate of one PU for each downstream workstation that requires visibility to the host.

This way, each PU on the gateway has an SSCP-PU session with the host, and the gateway code has been enhanced to provide a one-to-one relationship between a PU on the gateway and a downstream PU. In other words, each gateway PU becomes dedicated to a specific downstream PU and acts like a phantom PU. This way, the gateway knows that any data received on the SSCP-PU session, such as PUX, is intended for the downstream workstation that has been defined as dedicated to PUX.

In the diagram here, when the NetView operator sends a command destined to PUY, the command flows on the SSCP-PU session (in the LU 6.2 pipe) from the host to the PUY in the gateway. The gateway then examines its definitions and finds that PUY is dedicated to PUY1. The command is then forwarded on the SSCP-PU session between the gateway and PUY1. In essence, PUY is only there to be able to act as a replacement for PUY1.

In this illustration (where we assume that the gateway is adjacent to the subarea) note that the DLUR/DLUS function is not required (in theory) to make this work. However, it is not very practical to do this without DLUR/DLUS, because of the need for multiple physical links to the same host. This means that you have to use multiple adapters since IBM 2217 MpC SNA support can handle only one SAP. We illustrated this case only to show the principle of how this works.

4.2.3 Downstream PU Support Using DLUS/DLUR

A more practical scenario is where the DLUR/DLUS function is used on the gateway in order to have multiple PUs, all serviced through a single physical/logical connection to a host. Through this single connection, all the SSCP-PU and SSCP-LU sessions can flow for all the PUs defined on the gateway.

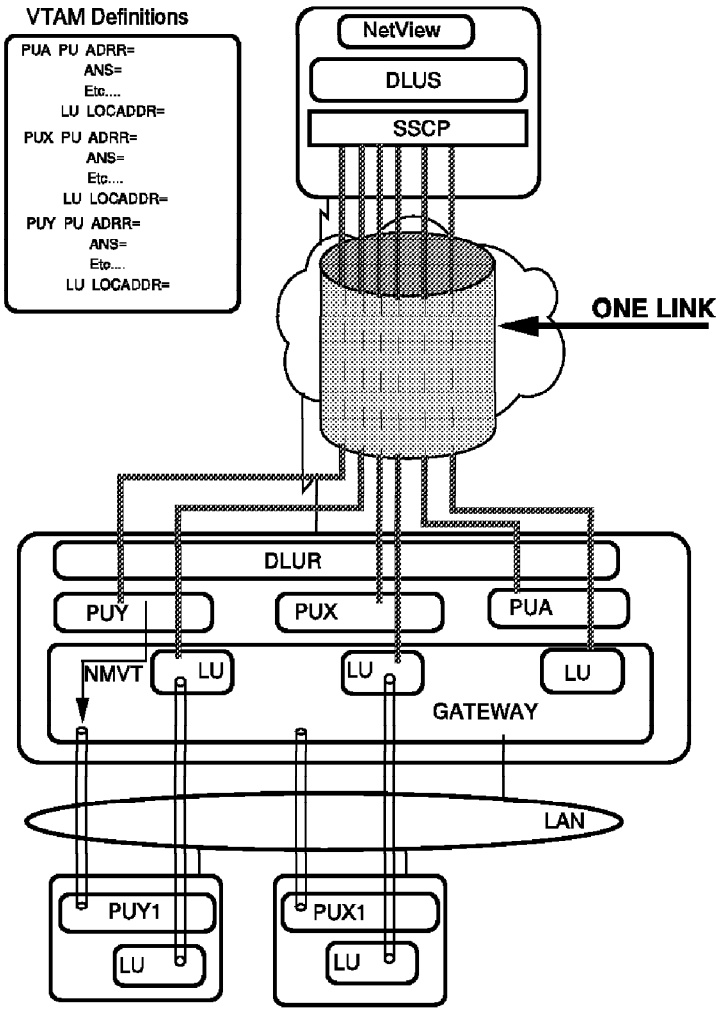


Figure 64. Multiple PUs Using DLUS/DLUR

Each of the DLUR supported PUs would be identified by a different node ID which would then be resolved at VTAM into a Switched PU with a matching IDNUM/IDBLK. In this illustration, the gateway could be adjacent to the subarea, but it does not have to be.

Any downstream PU requiring host visibility for network management purposes can then be assigned a dedicated PU on the gateway. The advantage of not requiring a host VTAM definition for a downstream PU is lost, but the advantage of being able to address the PU from NetView is gained, which is a good trade-off in many cases, especially for migration purposes or older devices, such as 4702 banking controllers, which require this function.

4.3 Scenario 1: Cascaded SNA Gateways

In this scenario, we configure an SNA Gateway (2217-B) supporting downstream workstations. In turn, the SNA Gateway (2217-B) is also upstream connected to a second SNA Gateway (2217-A) in order to access a VTAM subarea (or APPN) host system. In this scenario, dependent LU requester (DLUR) is not required, and therefore, the VTAM system is not required to have APPN support. This configuration should only be used if you do not have support of APPN and dependent LU server (DLUS) in your VTAM system. Otherwise, it is recommended that you design your network to include dependent LU requester (DLUR) and dependent LU server (DLUS) support.

Figure 65 illustrates the configuration. In this scenario, 2217-C can also be configured to provide the same support as the one provided by 2217-B.

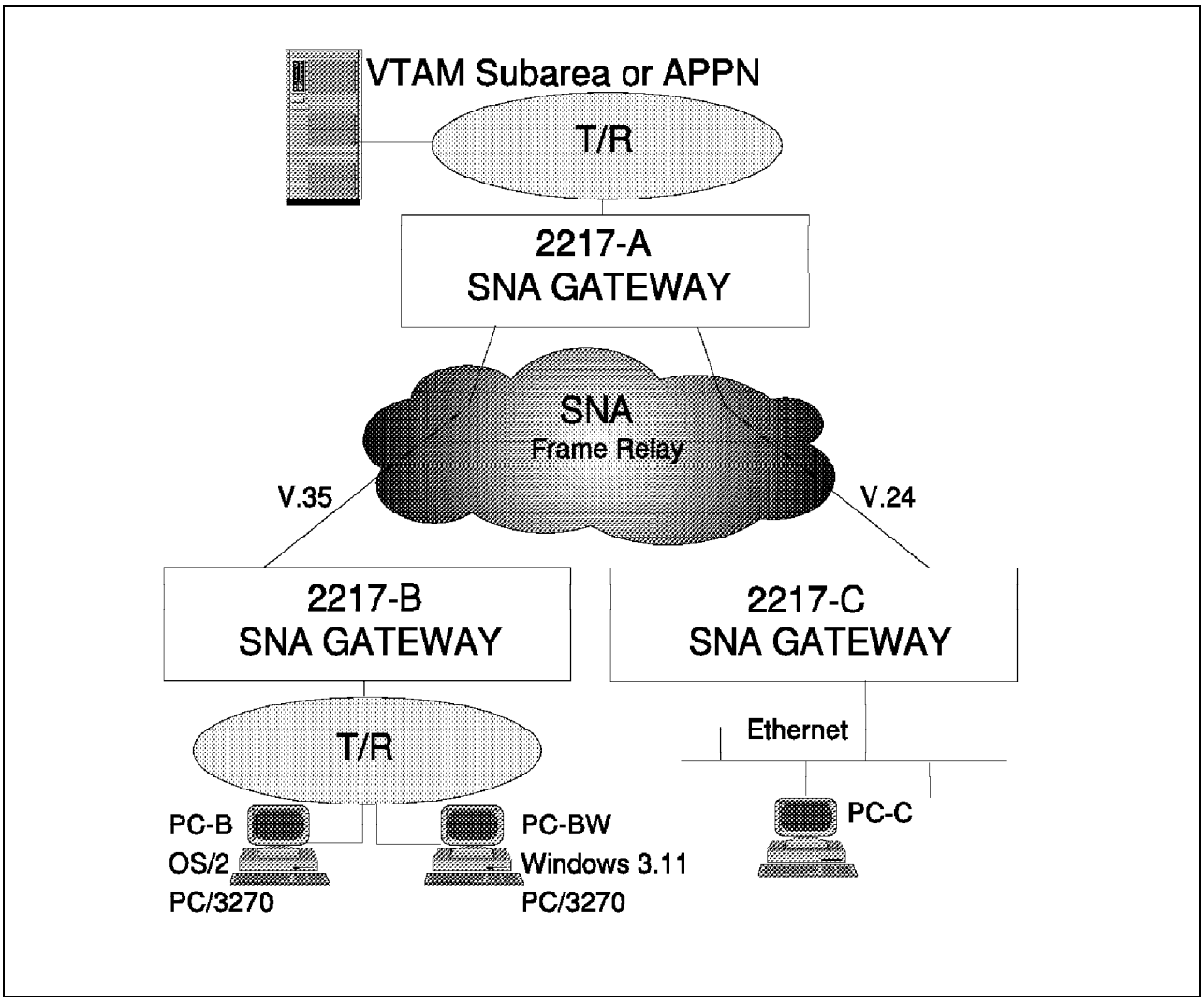


Figure 65. Cascaded SNA Gateways

4.3.1 Configuration of 2217-A

The IBM 2217 MpC (2217-A) is configured to support a T/R host connection to a VTAM system and two frame relay downstream connections to SNA Gateways 2217-B and 2217-C.

4.3.1.1 SNA Local Node Characteristics

In this panel, we enter the network ID and the node name of 2217-A (USIBMRA.A2217). Because 2217-A is adjacent to the VTAM system, it does not have to be defined as a network node in this case. In fact, it could be an end node connected to a VTAM subarea system if required. In this case, no CP-CP sessions will be established and we actually obtain an LEN connection.

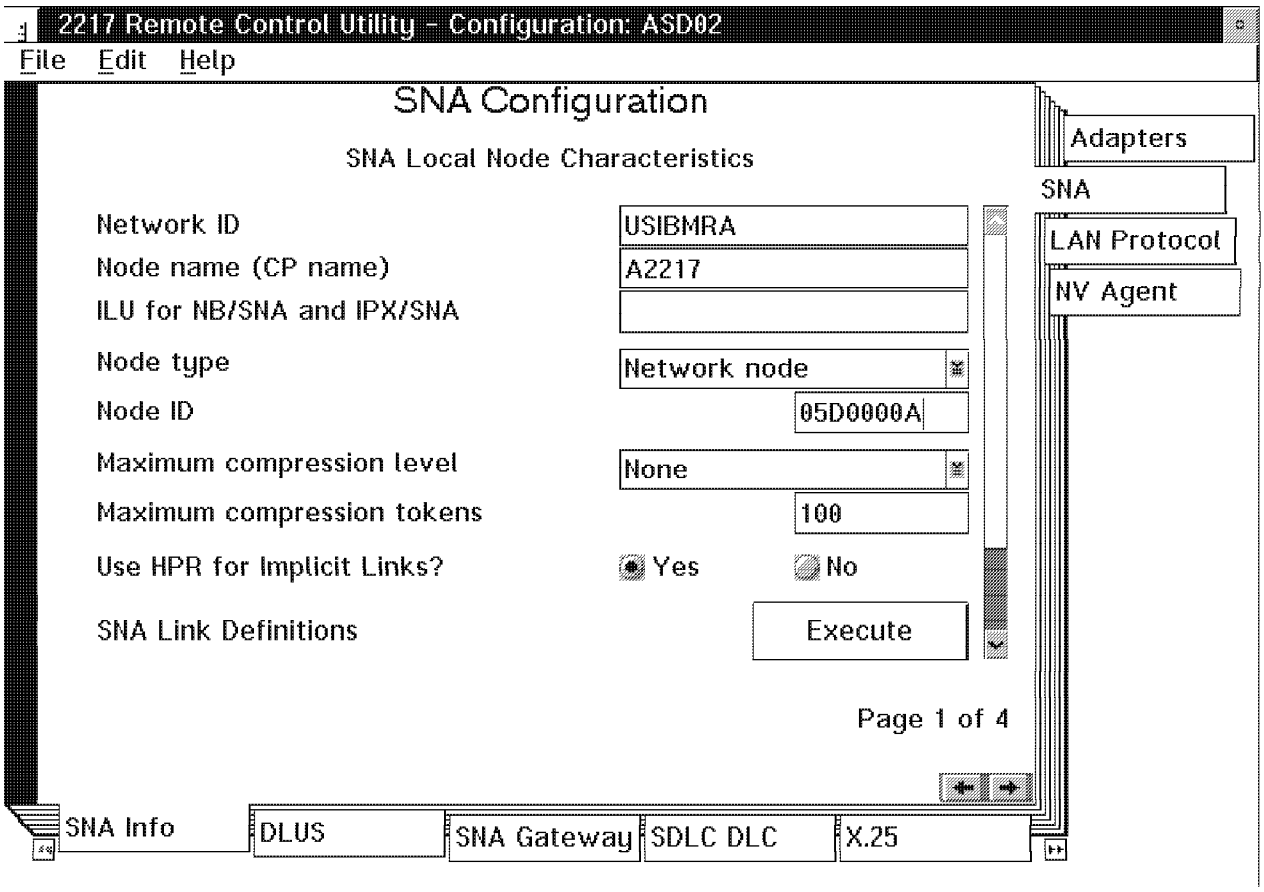


Figure 66. SNA Local Node Characteristics (2217-A)

4.3.1.2 Adapters

In this configuration, 2217-A needs a configuration for the LAN adapter (T/R) and the WAN frame relay adapters to 2217-B and 2217-C. The adapter configurations should be entered as described in Figure 22 on page 43 (LAN Adapter) and Figure 23 on page 44 (WAN Adapter).

4.3.1.3 SNA Links

In this panel, you define the host link to the VTAM system and the two frame relay downstream connections to 2217-B and 2217-C.

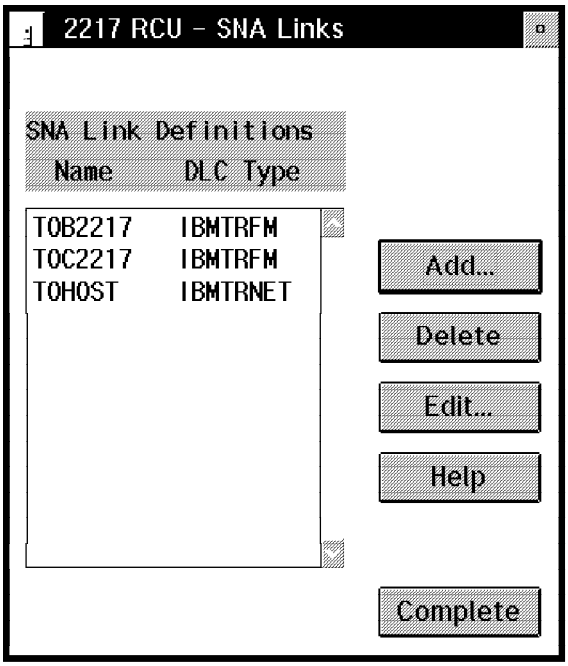


Figure 67. SNA Links to VTAM and Downstream Gateways

4.3.1.4 Host Link

You need to configure that you want to solicit an SSCP session (SSCP-PU session). Select **Continue** for additional link parameters.

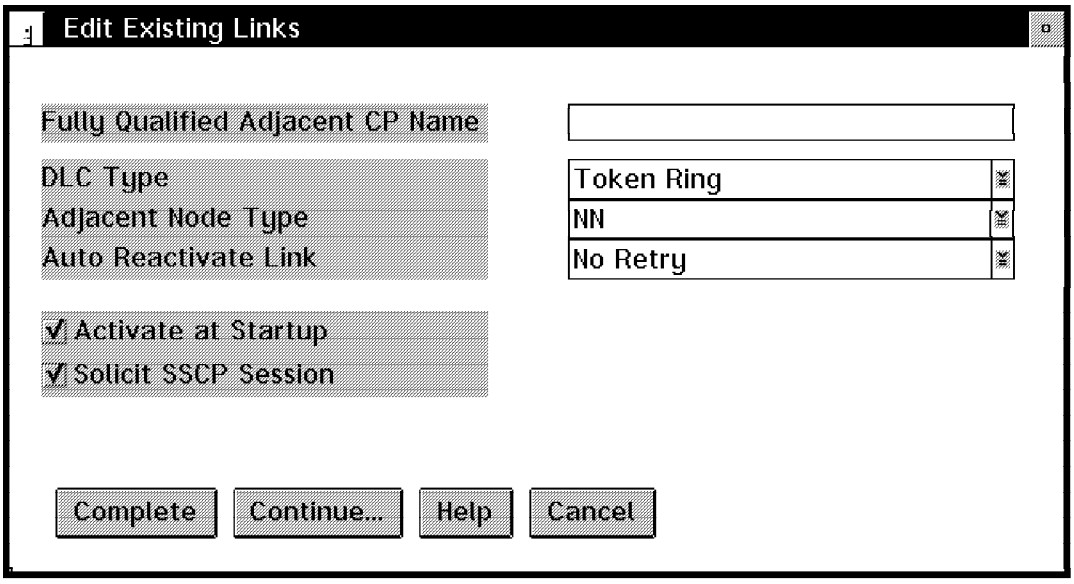


Figure 68. Host Connection to VTAM System

In the following panel, select **CP-CP Session Support** and **HPR Support** if required in your configuration. However, you must provide the T/R destination address.

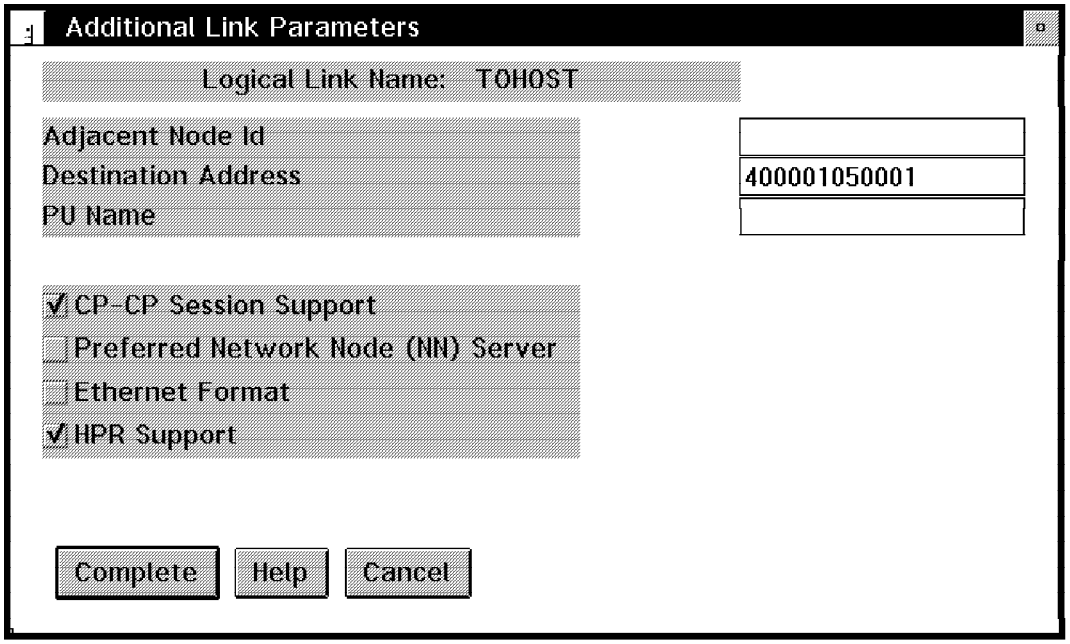


Figure 69. Providing the Host T/R Destination Address

4.3.1.5 Defining Your LU Pools to the Host

In this configuration, we decide to use host LU pools; the LU pool name associated with the host link is GWPOOLA. A range of NAU addresses must also be specified.

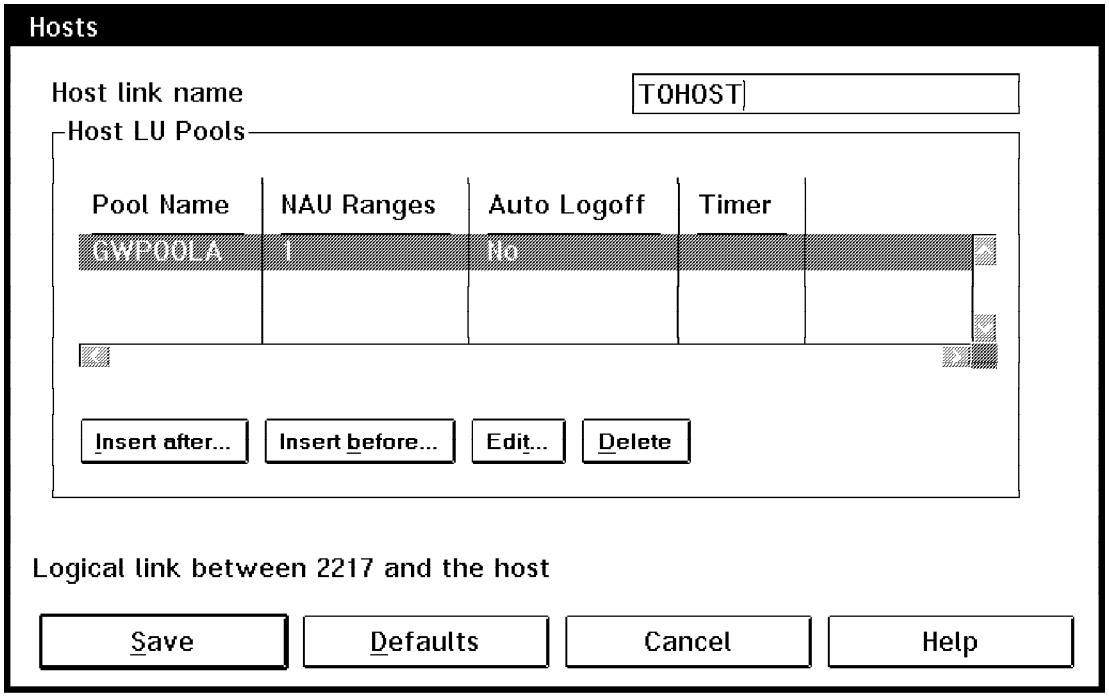


Figure 70. Host LU Pool Definitions

4.3.1.6 Defining Downstream Workstations

Next, we define downstream LUs for any DLC type (NULL). In this panel, you also configure the host link connection and the host LU pool to be used for the specified downstream LU. You also need to specify the NAU address for the downstream LU.

Note

Downstream dependent LU sessions are actually coming from the SNA Gateways in 2217-B and 2217-C.

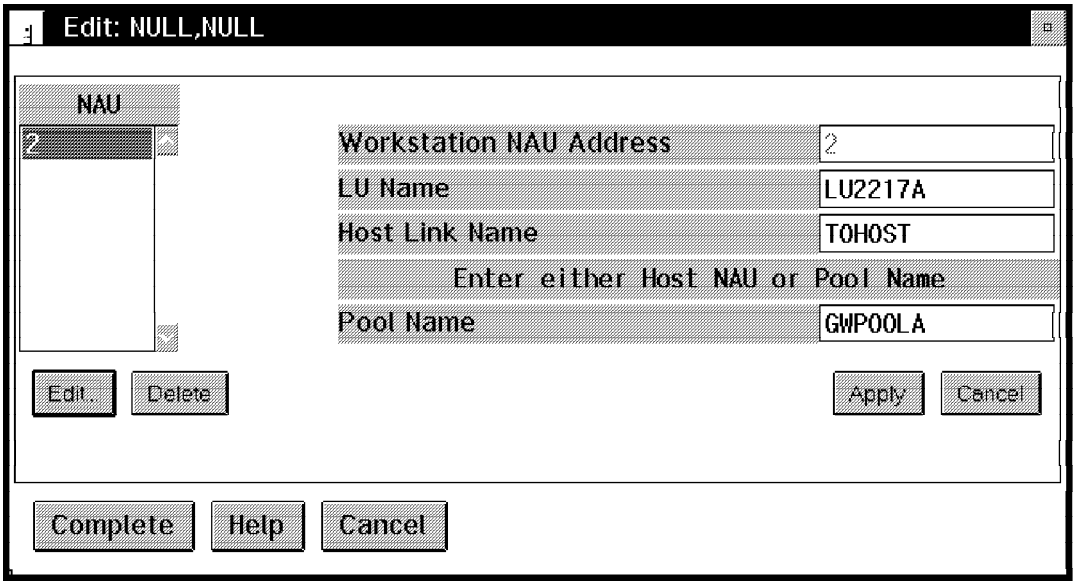


Figure 71. Defining a Downstream LU

- **DLC type:** For implicit workstation definitions, specify the DLC type (Ethernet, X.25, SDLC, Token Ring, Frame Relay, Null). To allow any DLC type you can keep the default value (Null).
- **Link Name:** It specifies the name of the link. For implicit workstations use the default value (Null).
- **Dedicated Host Link Name:** It specifies the dedicated host link name for the gateway workstation being defined.
- **Worstation NAU Address:** It specifies the LU address in the downstream node.
- **LU name:** It specifies the name of the downstream LU. Choose any arbitrary name but it must be unique.
- **Host Link Name:** It identifies the upstream host link (SNA link) to be used.
- **Pool name:** Either a host NAU address or an already defined host LU pool name must be entered.

4.3.2 Configuration of 2217-B

In a similar way, an SNA Gateway must be configured in 2217-B. The SNA Gateway communicates with 2217-A upstream (host), and it has downstream workstations of any type but using dependent LU sessions. Here we show you the most important configuration panels.

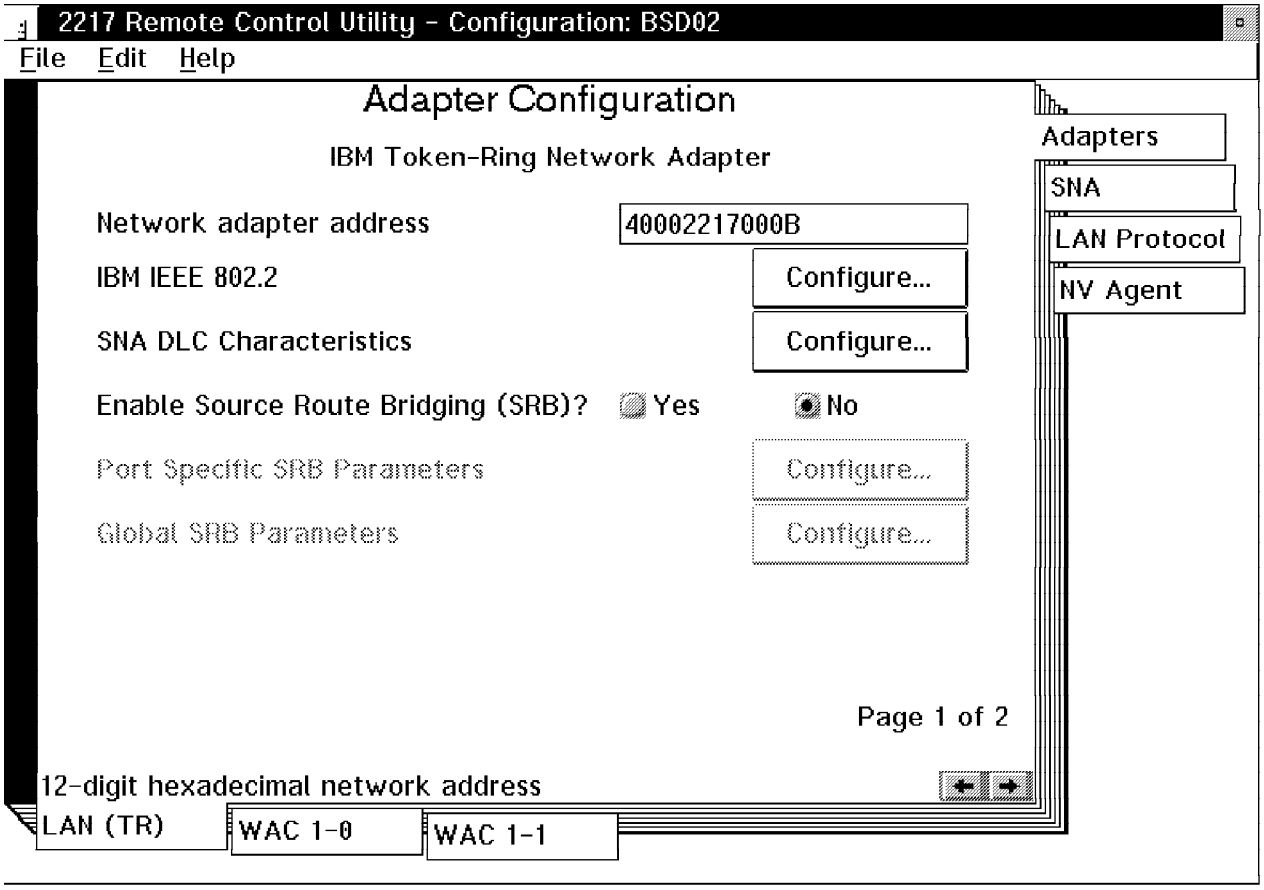


Figure 72. T/R Adapter Configuration in 2217-B

Next, we show you the SNA local node configuration in 2217-B and the frame relay connection to 2217-A.

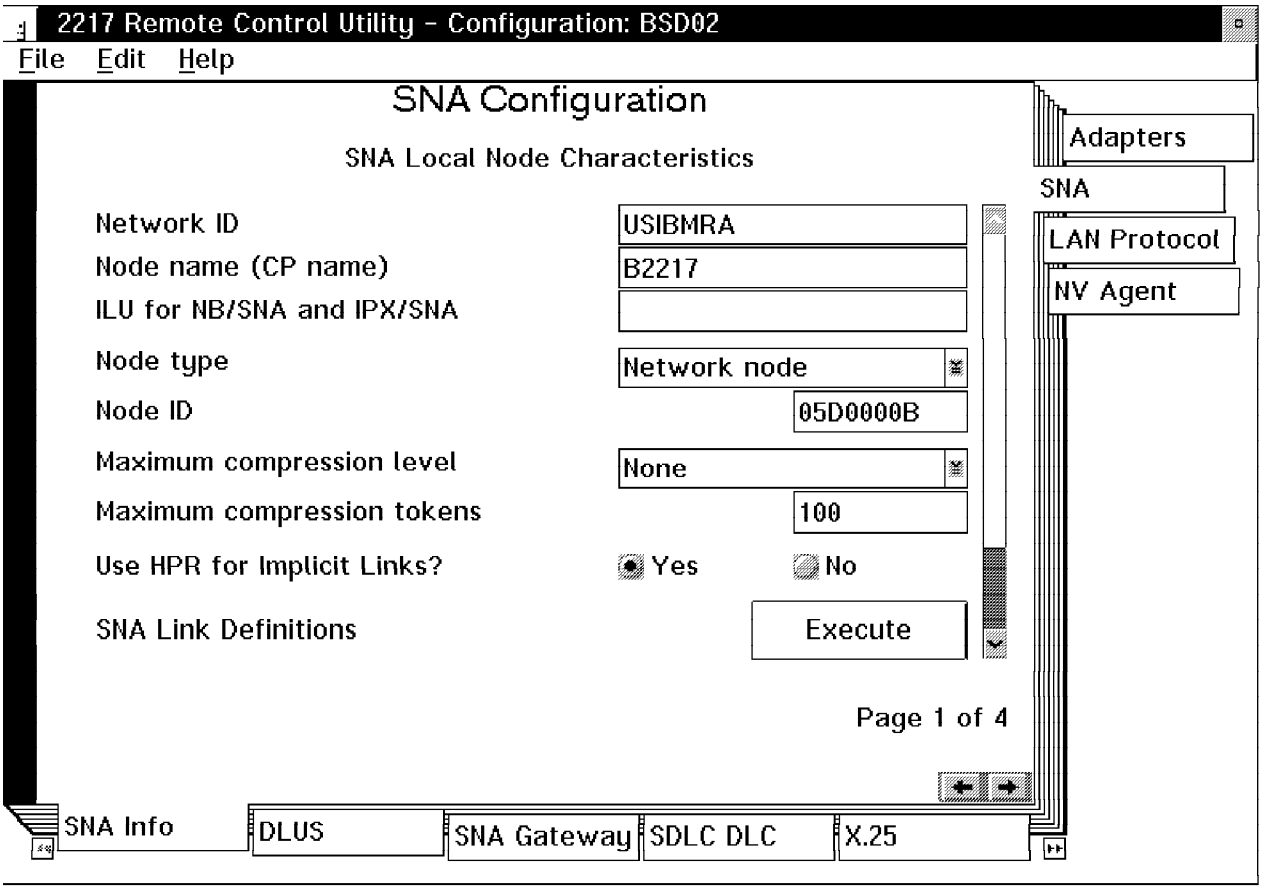


Figure 73. SNA Local Node Configuration in 2217-B

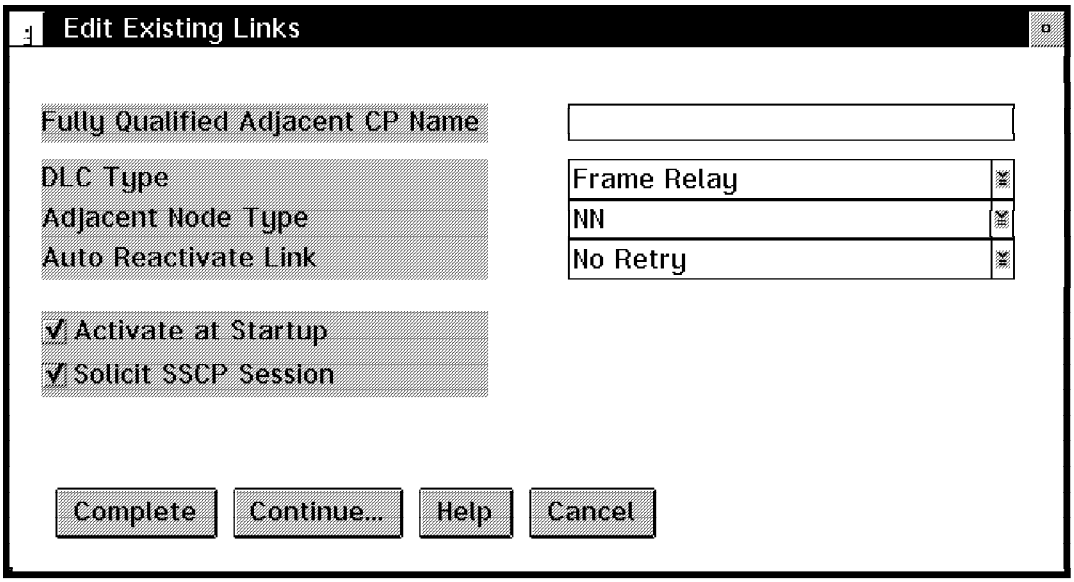


Figure 74. Frame Relay Connection to 2217-A

In the following panel, select **CP-CP Session Support** and **HPR Support** if required in your configuration. However, you must provide the destination address (frame relay).

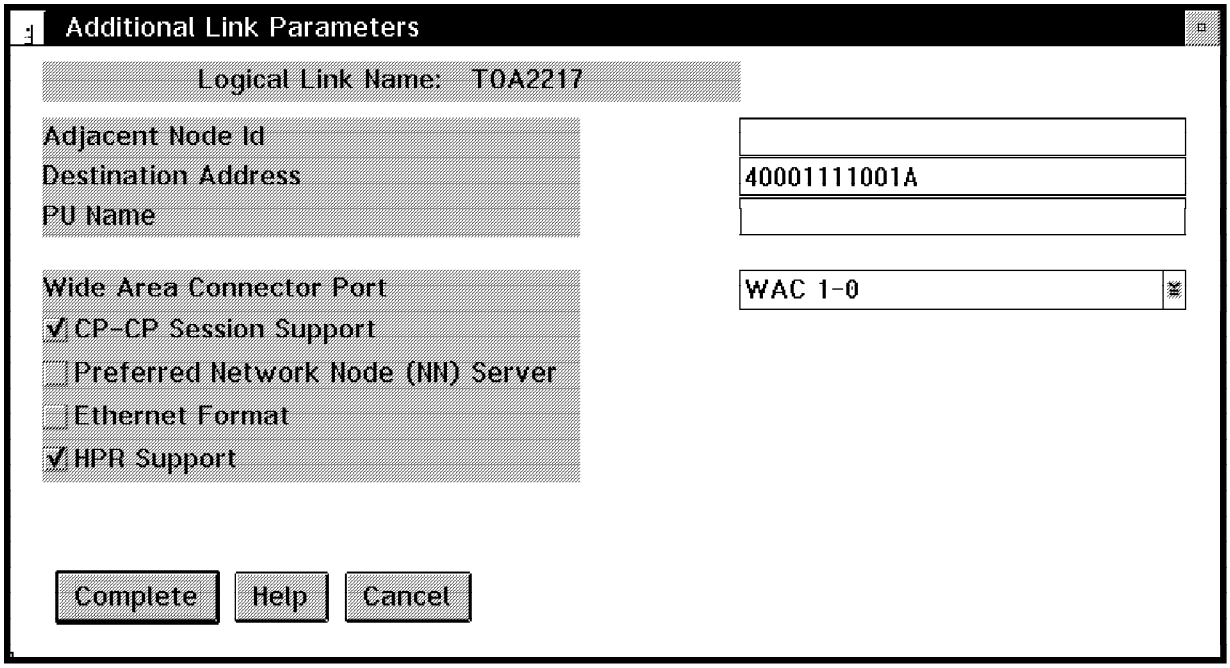


Figure 75. Additional Link Parameters (Frame Relay)

You also need to define the downstream workstation LUs.

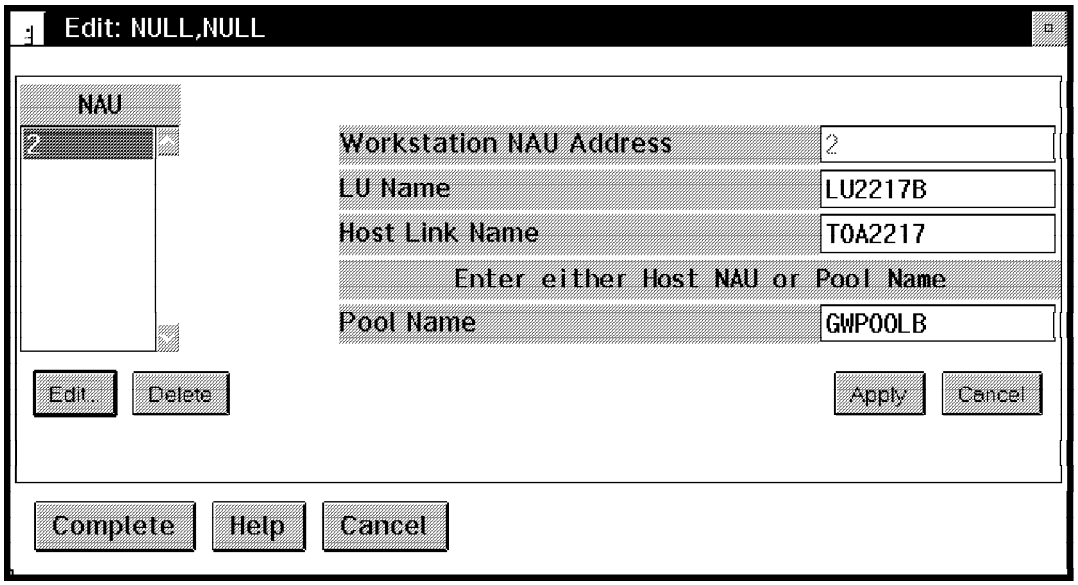


Figure 76. Defining Downstream LUs in 2217-B

4.4 Scenario 2: SNA Gateway Using DLUR Support

In this scenario, we include dependent LU requester (DLUR) support in the IBM 2217 MpC SNA Gateway 2217-B. The host system requires VTAM to support APPN and dependent LU server (DLUS).

Note

It is not required to define an SNA Gateway in 2217-A, and therefore, 2217-A is defined as a network node (NN) only.

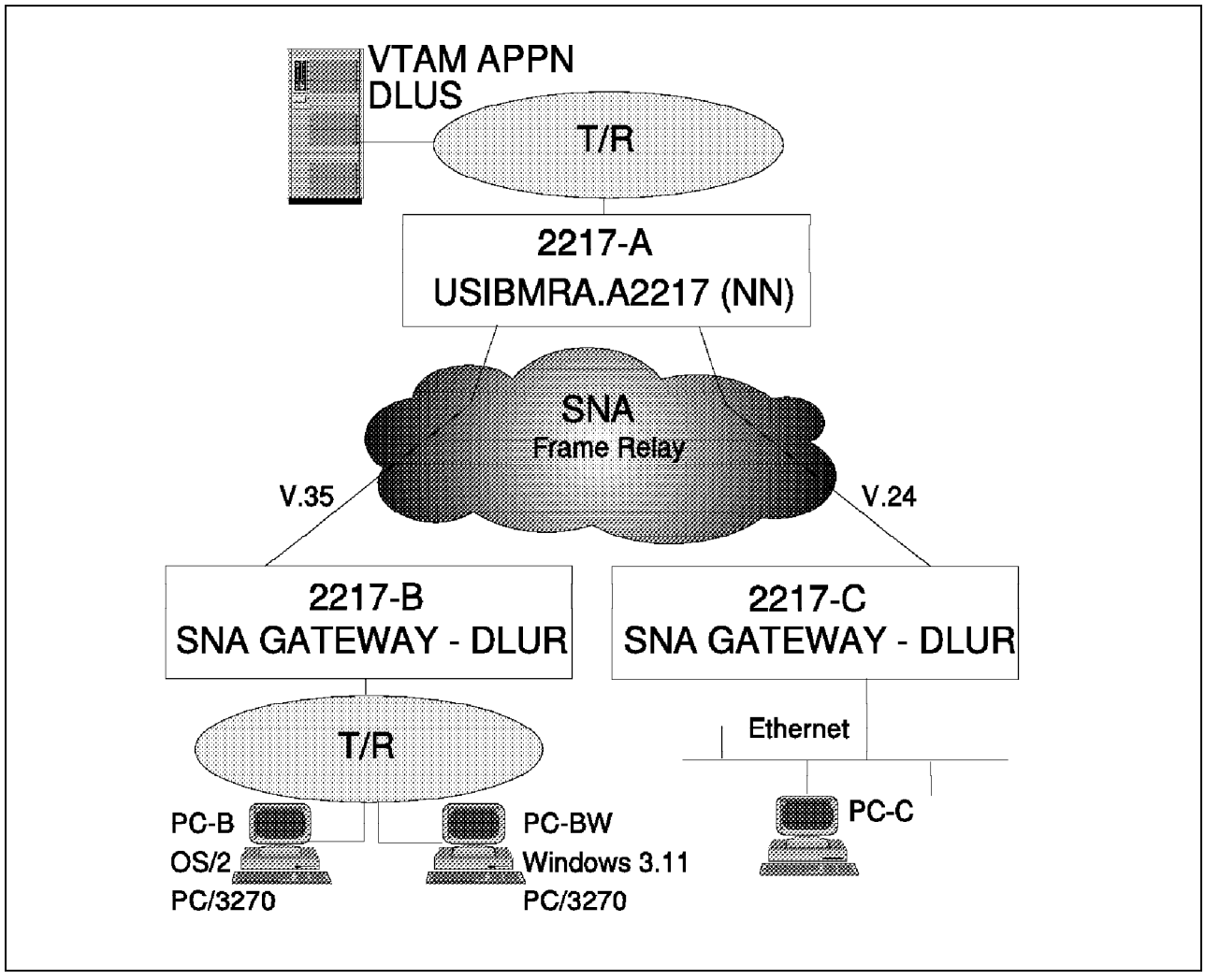


Figure 77. SNA Gateway Using Dependent LU Requester (DLUR)

4.4.1 Configuration of 2217-A

IBM 2217 MpC (2217-A) is configured as a network node. Please see Chapter 2, “SNA Enhancements” on page 19 for details on how to configure an IBM 2217 MpC network node.

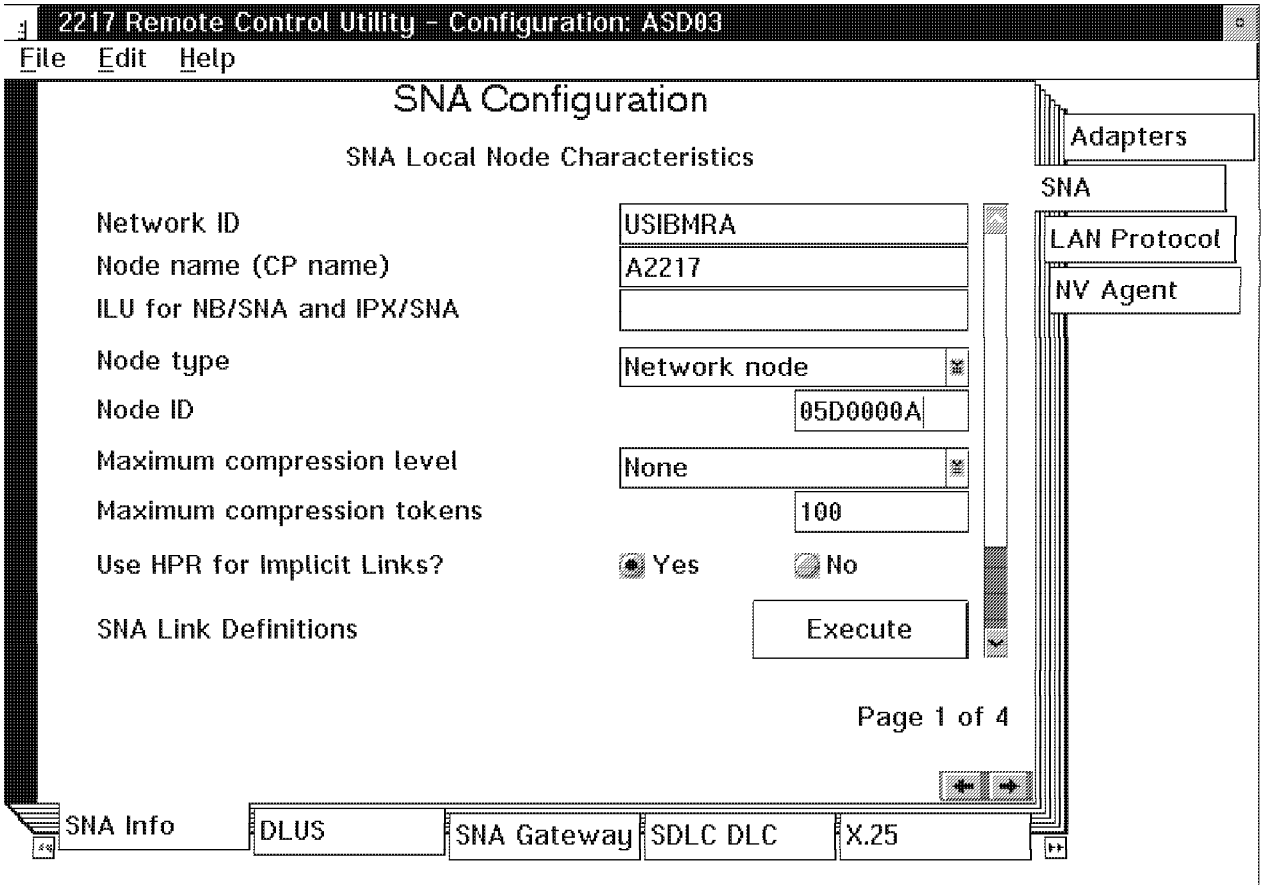


Figure 78. Local Node Characteristics for 2217-A

4.4.2 Configuration of 2217-B

In this scenario, we include dependent LU requester (DLUR) support in 2217-B. The fully qualified dependent LU server (DLUS) name is USIBMRA.RAA, which is the same name as the VTAM system CP name. The IBM 2217 MpC SNA Gateway in 2217-B is now configured to use the DLUR link as the host link (DLUS001).

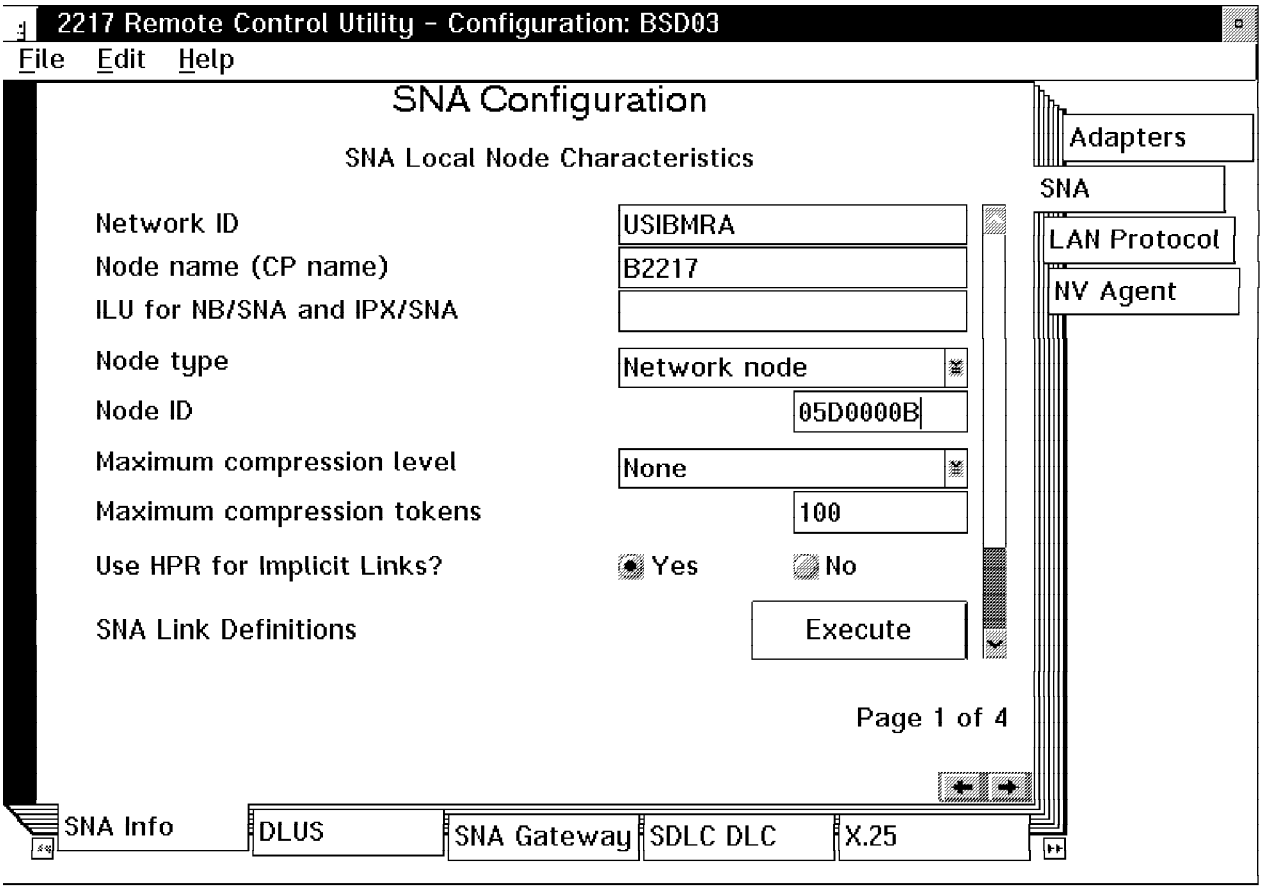


Figure 79. SNA Local Node Characteristics for 2217-B

4.4.2.1 Dependent LU Server Configuration

In this panel, you define the dependent LU server (DLUS) options. DLUS001 is the name to be used by the SNA Gateway as the host link. You will find the DLUS configuration panel in the SNA folder.

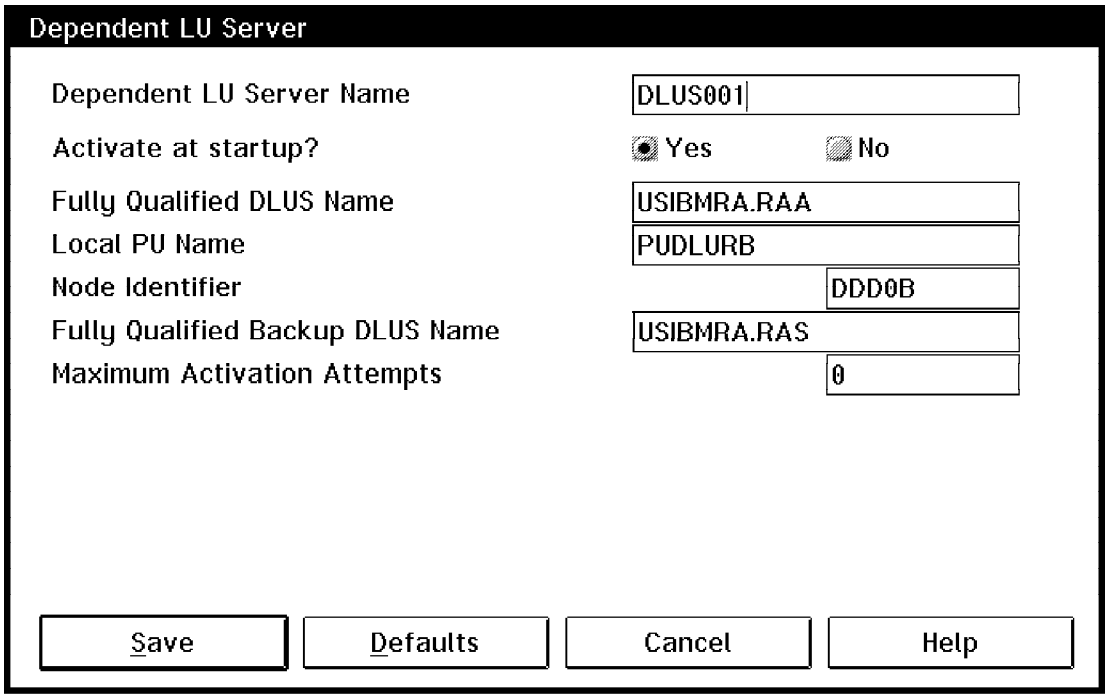


Figure 80. Dependent LU Server

- **Dependent LU Server Name:** Provide a name for your DLUS/DLUR link. You will refer to this name in your SNA Gateway configuration.
- **Activate at startup:** Select this option if you want your DLUR link to be activated at initialization time.
- **Fully Qualified DLUS name:** This is the name of your VTAM dependent LU server (DLUS).
- **Local PU Name:** This is an internal PU name. This name does not flow out of the IBM 2217 MpC.
- **Node Identifier:** Enter the node ID for the PU to be used. It must be unique.
- **Fully Backup Qualified DLUS Name:** This is the name of a backup VTAM dependent LU server (DLUS). If no backup, enter the name of your primary DLUS.
- **Maximum Activation Attempts:** If you leave the default of 0 it means that the number of activation attempts will be infinite.

4.4.2.2 Defining the Connection to 2217-A

The link between 2217-B and 2217-A is a frame relay connection.

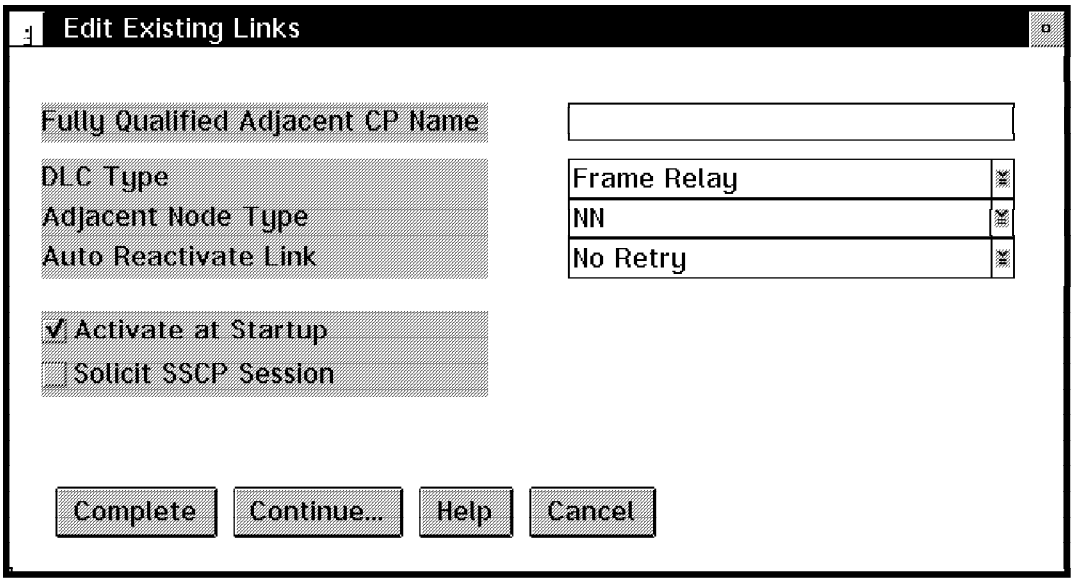


Figure 81. Defining a Frame Relay Link for SNA

Select **Continue...** to enter the additional SNA options for you frame relay link.

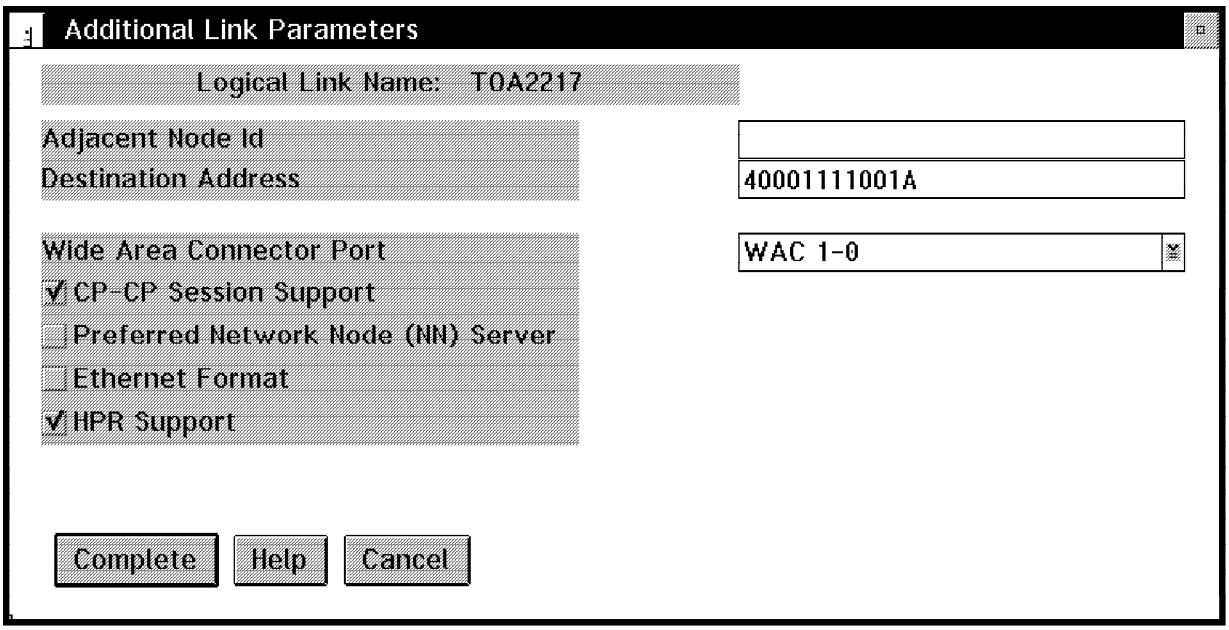


Figure 82. Frame Relay Connection - Additional Parameters

4.4.2.3 Defining the SNA Gateway (2217-B)

The SNA Gateway is now defined, including a host LU pool, and the required downstream LUs are connected to the DLUR link.

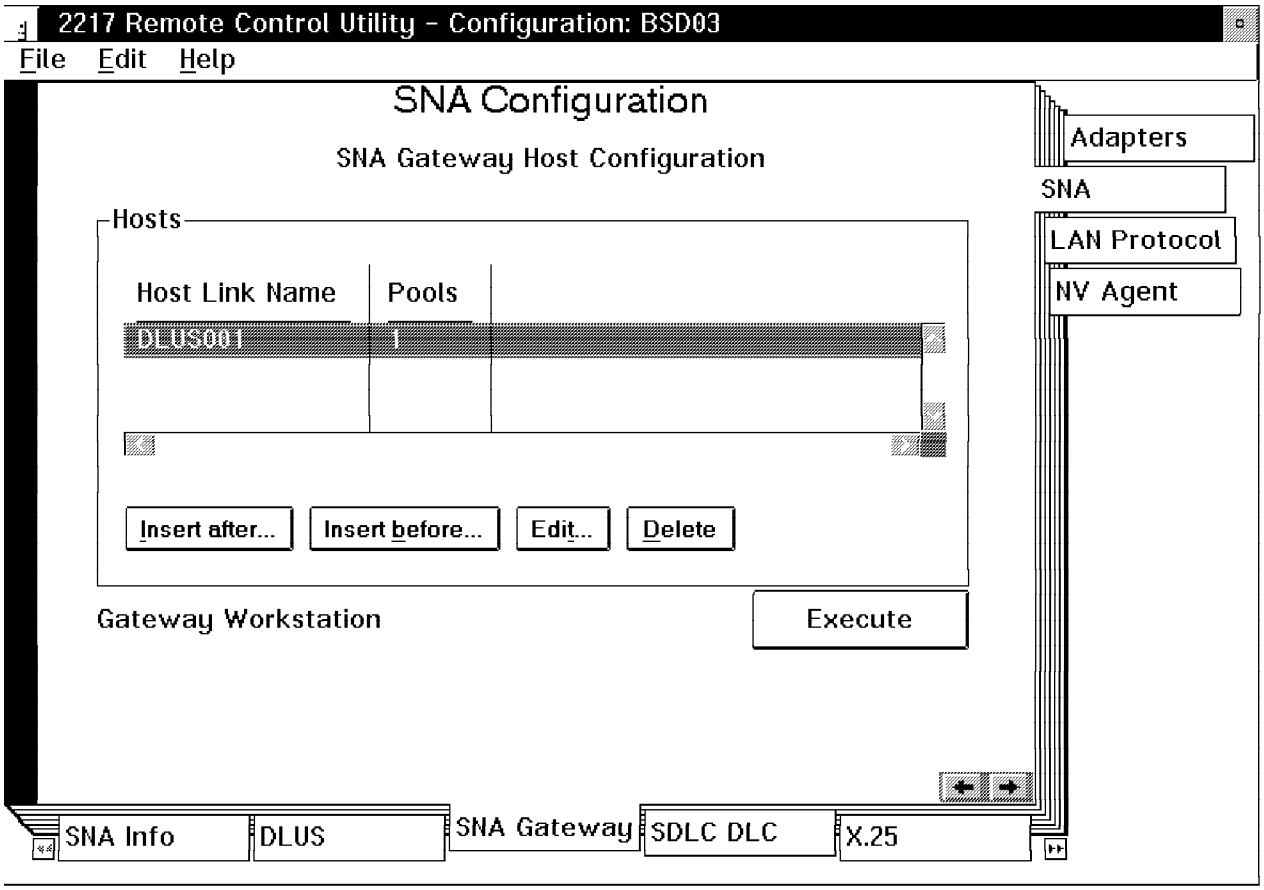


Figure 83. SNA Gateway Host Configuration

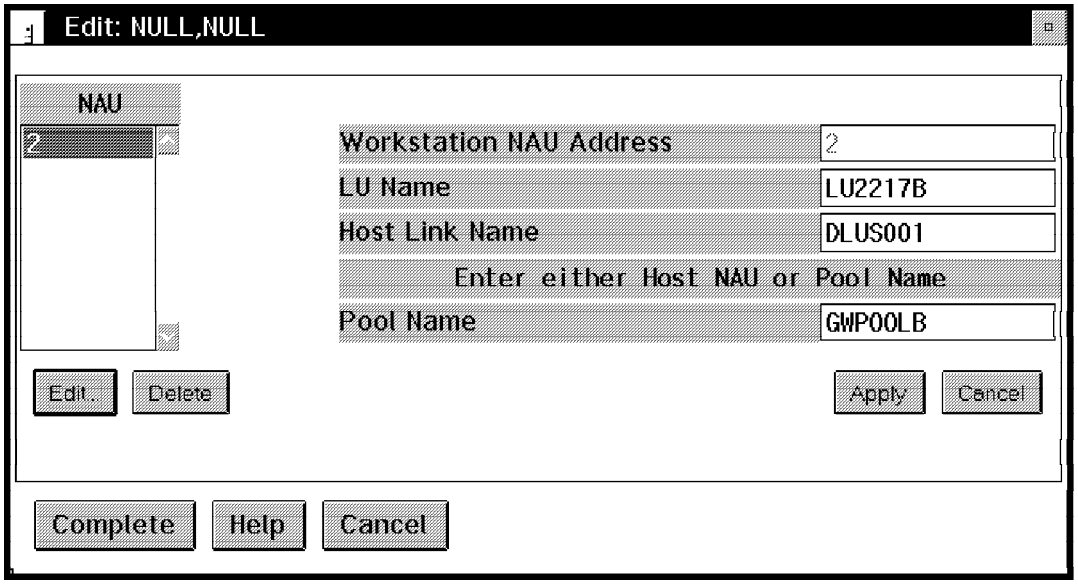


Figure 84. Defining a Downstream Workstation LU Using a DLUR Link

Part 3. Sockets Applications

Chapter 5. Sockets Applications over SNA

The IBM 2217 MpC allows Sockets applications such as PING, FTP, Telnet, Web browsers and many others to run over SNA networks. The transport is an SNA APPC session and the TCP/IP protocols are translated into APPC full-duplex conversations.

In addition, applications that use Sockets over SNA on other platforms can also communicate between them. When a Sockets over SNA Gateway is attached to the local network, sockets application programs can communicate even though the applications may reside on networks using different transport protocols. The IBM 2217 MpC provides support and it can be configured as a Sockets over SNA Gateway connecting TCP/IP networks to an SNA network. In this chapter, we describe how to configure an IBM 2217 MpC in order to use it as a Sockets over SNA Gateway.

5.1 Sockets over SNA Gateway

If you are planning to run sockets applications between nodes in different networks (SNA and TCP/IP), you will need to configure the Sockets over SNA Gateway in the IBM 2217 MpC.

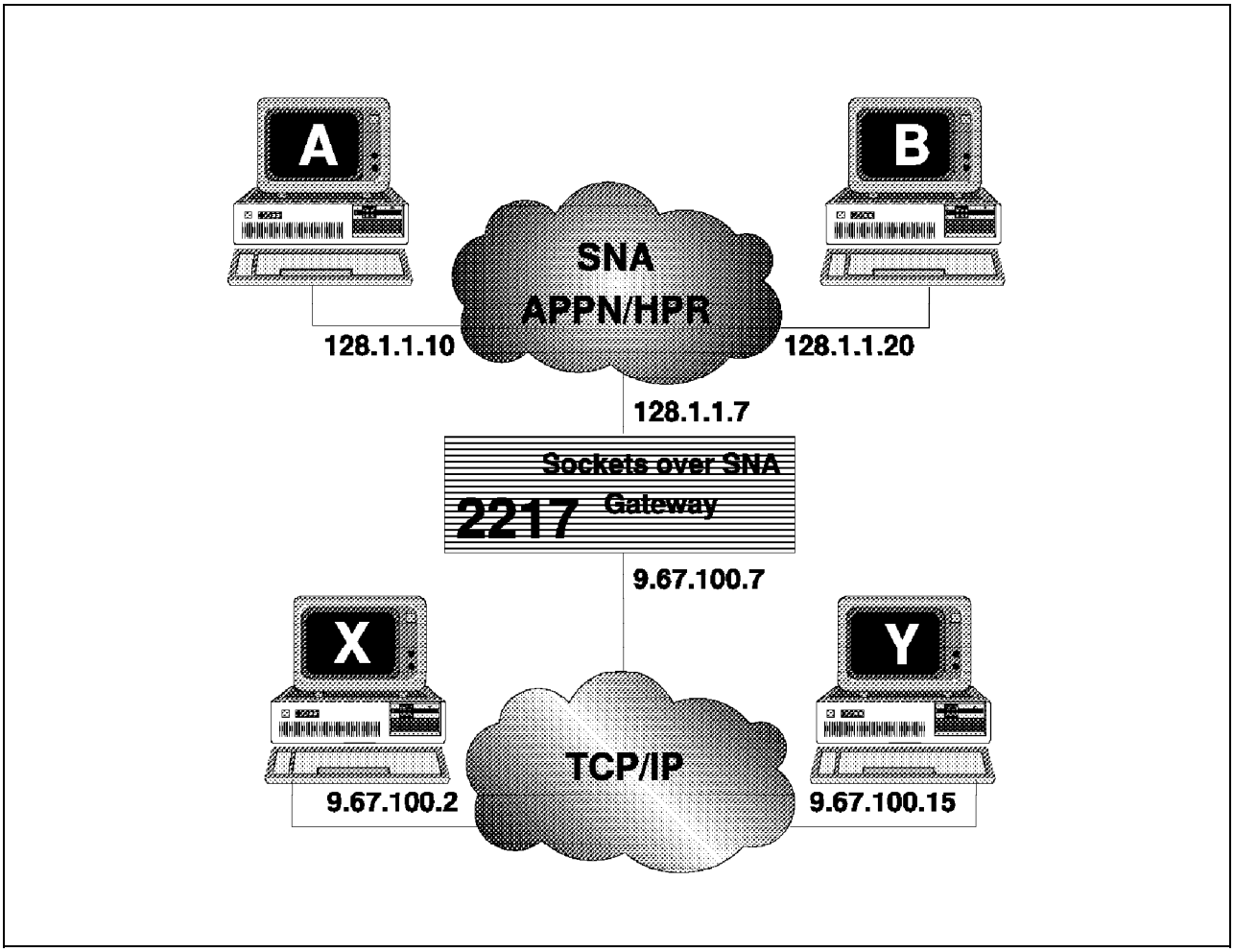


Figure 85. Sockets over SNA Gateway Function in IBM 2217 MpC

In order to enable communication between socket applications running on different types of networks, IBM 2217 MpC includes the following functions:

- Sockets over SNA
- TCP/IP node, operating as a router
- Protocol translator

The Sockets over SNA function enables IBM 2217 MpC to perform IP-LU address mapping. If Sockets over SNA Gateway determines that an IP address can be reached through the SNA network, the IP address is mapped to an SNA address. The information destined for that IP address is routed over the SNA network.

Note

Although IBM 2217 MpC Sockets over SNA Gateway supports all the TCP and UDP protocols, it does not support applications that use broadcasting.

An IBM 2217 MpC node configured with TCP/IP operates just like any TCP/IP node with multiple network connections. When a Sockets Gateway node receives information that is destined for a remote application on a native TCP/IP network, the information is routed through the gateway using TCP/IP routing algorithms.

The IBM 2217 MpC Sockets over SNA Gateway function enables an IBM 2217 MpC to transport TCP/IP data between SNA and IP networks:

- Socket applications running on different IP networks can communicate across an SNA network.
- Socket applications running on an SNA network can communicate with socket applications running on a native IP network.

TCP/IP data is routed over SNA using IBM's multiprotocol transport networking (MPTN) formats. APPC conversations are used to establish communication between socket application programs.

5.1.1 Mapping and Routing

To simplify IP-LU mapping, the following things are recommended:

- Use algorithmic mapping of IP addresses to LU names.
- Use one LU template for all Sockets over SNA nodes. With this approach:
  - Only one entry is needed in the IP-LU mapping table of each node to represent all other Sockets over SNA nodes.
  - New nodes can be added to the network without requiring any changes to the mapping tables of existing nodes.

To simplify network routing, it is recommended that you use one network address (or subnet address) for your Sockets over SNA network. If you are using subnetwork addressing for your IP network, it is recommended that you set up a single subnetwork for all Sockets over SNA nodes.

To install the Sockets over SNA function of the IBM 2217 MpC you have to consid er two major points:

- IP Routing

From the IP Routing point of view the SNA backbone network appears as a separate IP network or subnetwork. The conversion to the TCP/IP protocol based on the MPTN architecture is totally transparent to the workstations and the TCP/IP hosts. In most cases, the workstations are LAN attached and they see and define the SNA network like any other normal IP network.

This means that we have to define and maintain IP routes to and from this network as if the IBM 2217 MpC were a TCP/IP router.

This approach provides an advantage to end users, in the sense that they do not have to deal with the SNA definitions to reach a TCP/IP server on a different LAN which is only accessible over the SNA backbone.

The interface to the SNA network is one additional IP interface in the IBM 2217 MpC. It is called SNA0. It is always one interface, regardless of how many logical SNA links are active. In Figure 103 on page 134 you can see how the virtual IP network fits into TCP/IP networks and the corresponding routing information.

There are two different types of routing capabilities:

1. Static routing
2. Dynamic routing

- Defining the SNA Logical Units

  To transport the TCP/IP traffic over the SNA network, APPC sessions are established. Each of the LU names of the session partner refers to the virtual IP addresses of the SNA0 interface. During installation you must define which naming conventions you will use for the logical units. You can decide between two different possibilities: explicit or algorithmic address mapping.

5.1.2 IP Address Planning

At first you have to decide the range of IP addresses you want to use. If your company already uses TCP/IP protocol, usually a coordinator will provide you with the addresses. We decided to use the IP network address 192.168.220.0 for the virtual IP network. The addresses 192.168.221.0 and 192.168.222.0 were assigned to the remote LANs. The local LAN is already working with the IP network address 9.24.104.0 (using subnetting).

You will use one separate network or subnetwork for the virtual IP network. Depending on the number of 2217s, you should choose the corresponding class:

Table 4. IP Address Structure

Class	First Byte Value	Netmask	Number of Networks	2217s per Net
Class A	0-127	255.0.0.0	126	16,777,214
Class B	128-191	255.255.0.0	16,382	65,534
Class C	192-223	255.255.255.0	2,097,150	254
Class D	224-239	multicast address		
Class E	240-255	reserved address		

For example, IP netaddress 192.168.220.0 is a class C address and gives you the ability to define 254 2217s in one virtual IP network. The address 172.16.0.0 is a class B address and allows more than 16,000 2217s in one virtual network.

You can use subnetting but be aware that some functions such as variable subnetting are not supported. In general, the same rules apply as for all IP networks. That means keep it as simple as possible thus giving new colleagues the chance to understand routing and addressing within a reasonably short time.

We selected our network addresses from the range of the private IP addresses recommended in RFC 1918.

For more information regarding IP network design considerations (choosing IP addresses, routing, security and firewalls), see *The Basics of IP Network Design*, SG24-2580.

5.1.3 Explicit Address Mappings

When using explicit address mappings, specify the IP address and the fully qualified name of the partner LU that this address maps into. The fully qualified name is given by entering the network ID and the SNA LU name.

Explicit mapping is most effective if a very small number of nodes are using Sockets over SNA, or if you are initially setting up the network and want to test communication among a few nodes. Be aware, however, that assigning LU names to individual nodes creates considerable overhead. Each local node has to explicitly define each remote node with which it communicates.

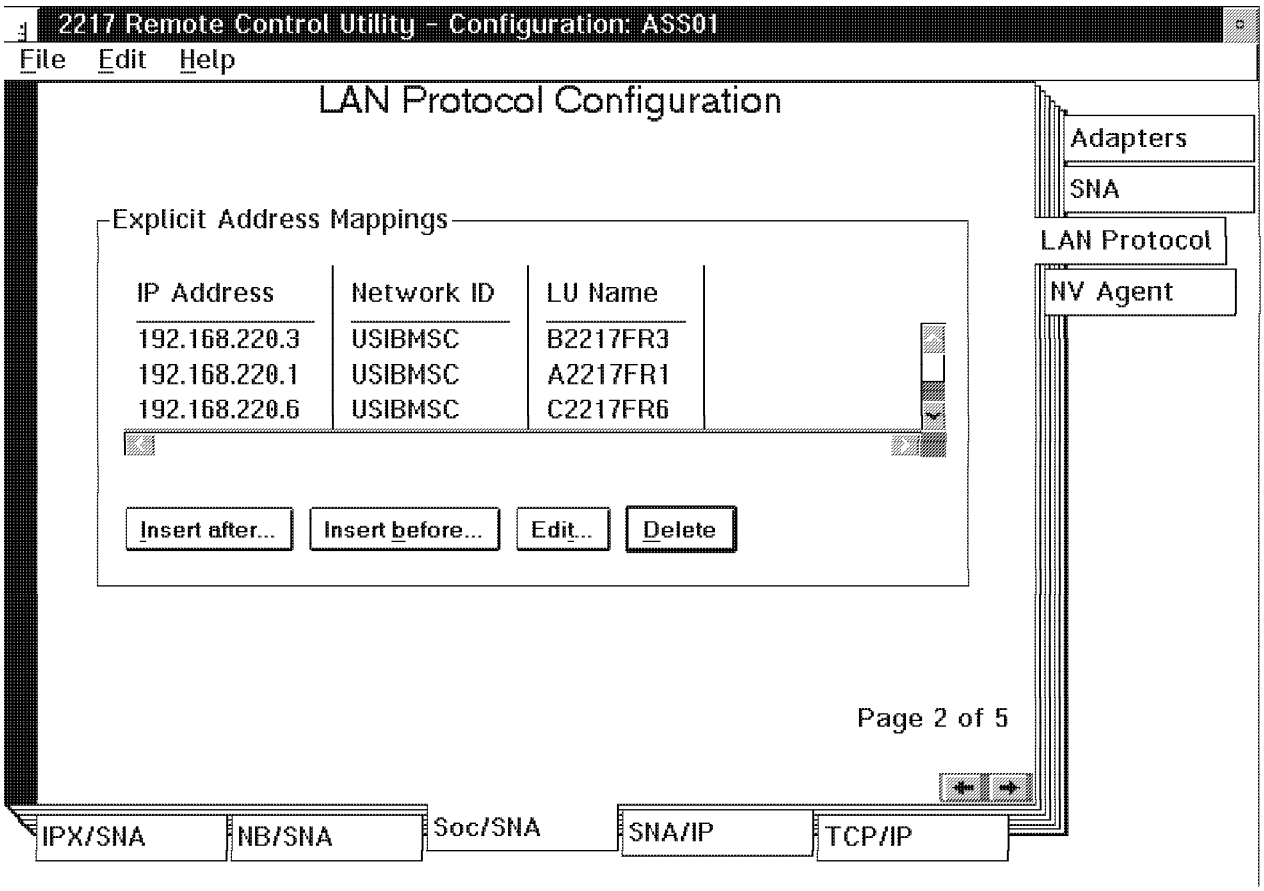


Figure 86. Explicit Address Mappings

5.1.4 Algorithmic Address Mappings

Algorithmic mapping is the recommended mapping method for networks with more than a few nodes. Using algorithmically generated LU names eliminates the need for a local node to define each remote node with which it will communicate. Individual mappings for remote destination nodes do not have to be defined on the local node. Sockets over SNA generates the address of the remote node using the IP address and the mapping information you supply.

Note

In algorithmic address mapping, it does not matter whether the IP address is a network address or a subnetwork address.

In the RCU, the following configuration panel is used to define IP-LU address mappings for IP network and IP subnetwork addresses.

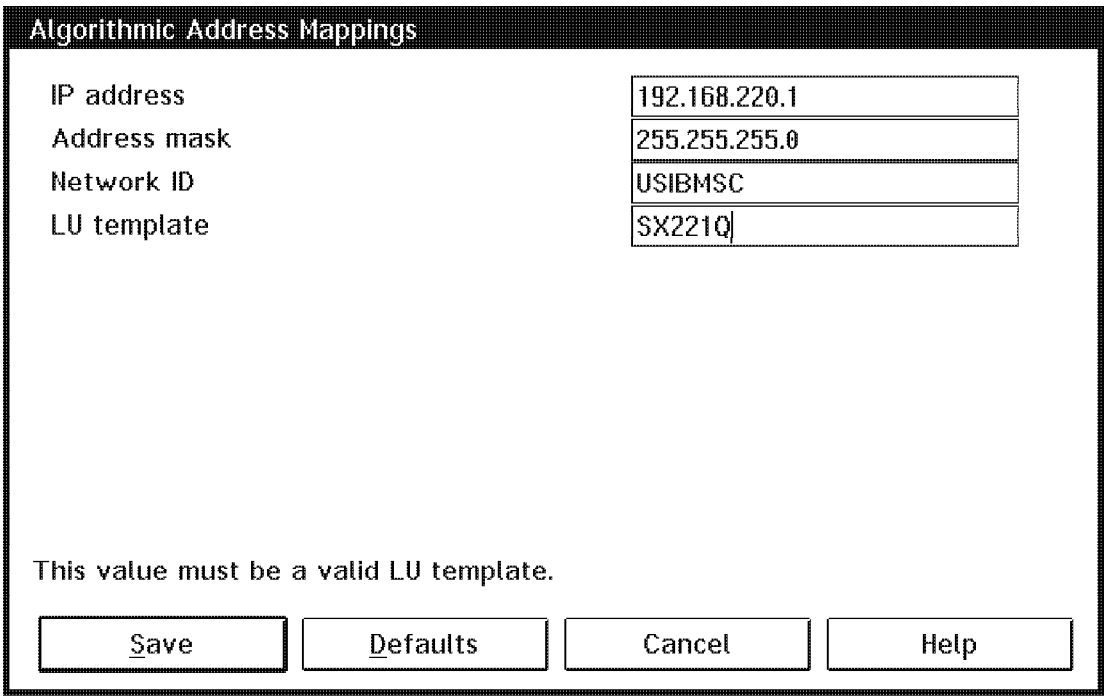


Figure 87. Algorithmic Address Mappings

When using algorithmic address mappings, the following fields must be entered:

- IP address

  IBM 2217 MpC maps this IP network address to the specified SNA network ID. Sockets over SNA uses the unmasked portion of the IP network address (host address) to generate the SNA LU name.

- Address mask

  This field is used to determine which portion of the IP address is mapped to the SNA network ID and which portion is mapped to the SNA LU name. For example, if address mask 255.255.255.0 is specified, the first 24 bits are mapped to the specified network ID and the last 8 bits are used to generate the SNA LU name.

- Network ID

Sockets over SNA maps the specified portion of the IP network address to this network ID.

- LU template

  This value defines the characters and the positions of the characters that are used when Sockets over SNA algorithmically generates the LU name.

The size of the template depends on the size of your address mask. The following table shows you the possible sizes of the LU template.

Table 5. Limitations for Defining LU Templates

Number of bits in the mask	Range of mask	Maximum Size of LU template
8-11 (includes class A addresses)	0xFF000000-0xFFE00000	3 characters
12-16 (includes class B addresses)	0xFFF00000-0xFFFF0000	4 characters
17-21	0xFFFF8000-0xFFFFF800	5 characters
22-26 (includes class C addresses)	0xFFFFFC00-0xFFFFFFC0	6 characters
27-31	0xFFFFFFE0-0xFFFFFFFE	7 characters
32	0xFFFFFFFF	8 characters

5.1.4.1 Generated LU Names

In most cases, you do not need to understand how the LU names are generated when using algorithmic address mappings. However, when using an LEN connection to VTAM subarea, you need to define the LUs in VTAM. In this case, you can use the RCU panels Operations and Administration of remote IBM 2217 MpC to display the corresponding LU name.

Note

You must be connected to an IBM 2217 MpC to generate LU names.

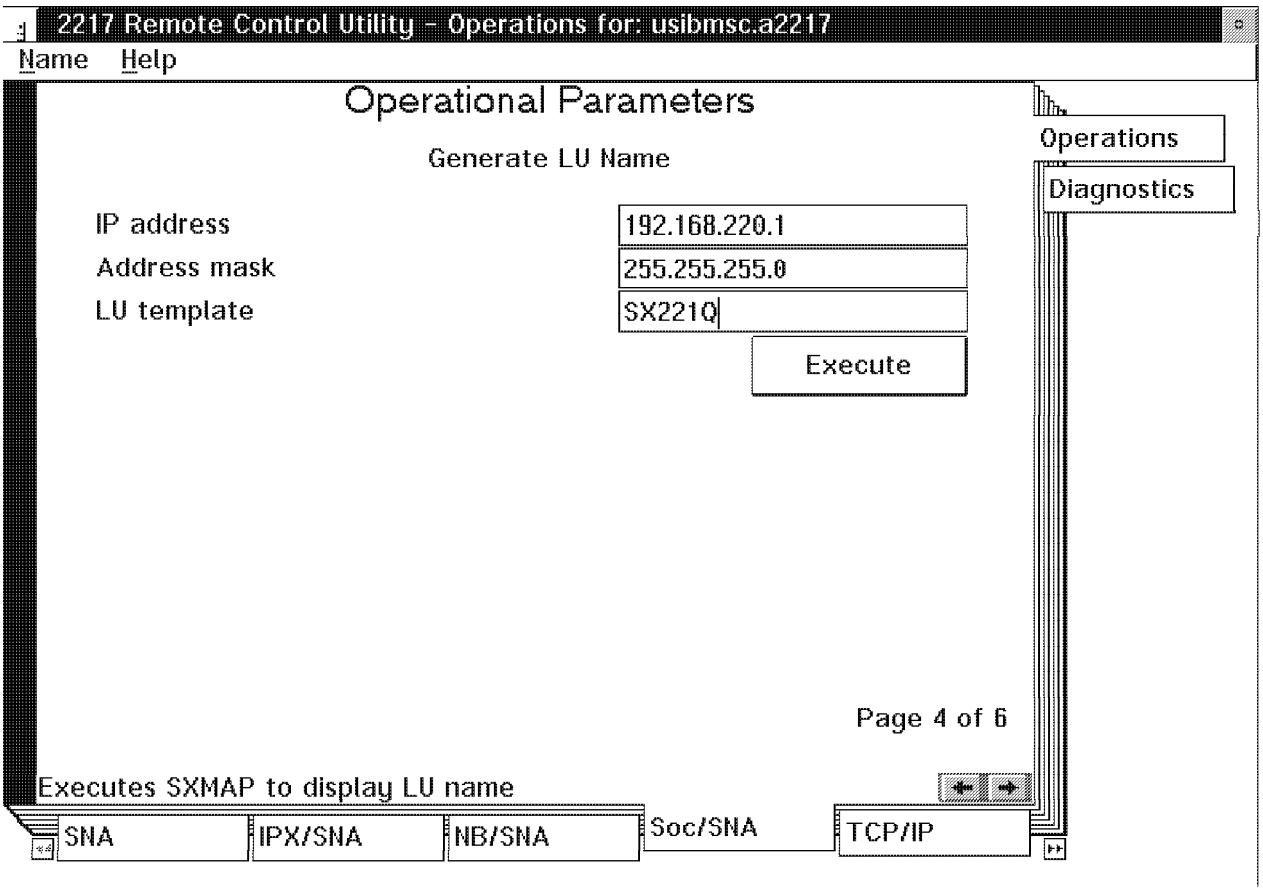


Figure 88. Generate LU Name Depending on LU Template and IP Address

For example, the IP address 192.168.220.1 with the LU template SX221Q results in the LU name SX221Q01. You could now use the LU name as the CP name. To find the corresponding LU names for all other 2217s you repeat this procedure for the other IP addresses.

You now have the advantage that you can use one single LU for all connections the IBM 2217 MpC has to support. The connection to the RCU runs over the CP name logical unit, and the connection for NetBios or IPX over SNA uses the CP name as well. You will also use the CP name for the Sockets over SNA connections. You only have to maintain one LU for each IBM 2217 MpC in the subarea network.

5.1.5 Session Modes

Sockets over SNA uses APPC conversations to enable communication between socket application programs. When an APPC conversation is established, Sockets over SNA defines the mode and associated session characteristics of the connection. Sockets over SNA uses the mode name to identify characteristics of the connection between the two Sockets over SNA nodes.

The mode specifies the class of service (COS) that will be used and the COS determines the priority of the session over the SNA network. For example, for file transfer applications you may want to use a low priority COS (#BATCH) and for inquiry applications you may to use a high priority COS such as #INTER.

The default Sockets over SNA mode is BLANK. You can change the default mode for Sockets over SNA and define your own for specific ports.

Note

If you specify a mode that is not already defined, you must also define the mode including the session characteristics for the APPC sessions using the mode.

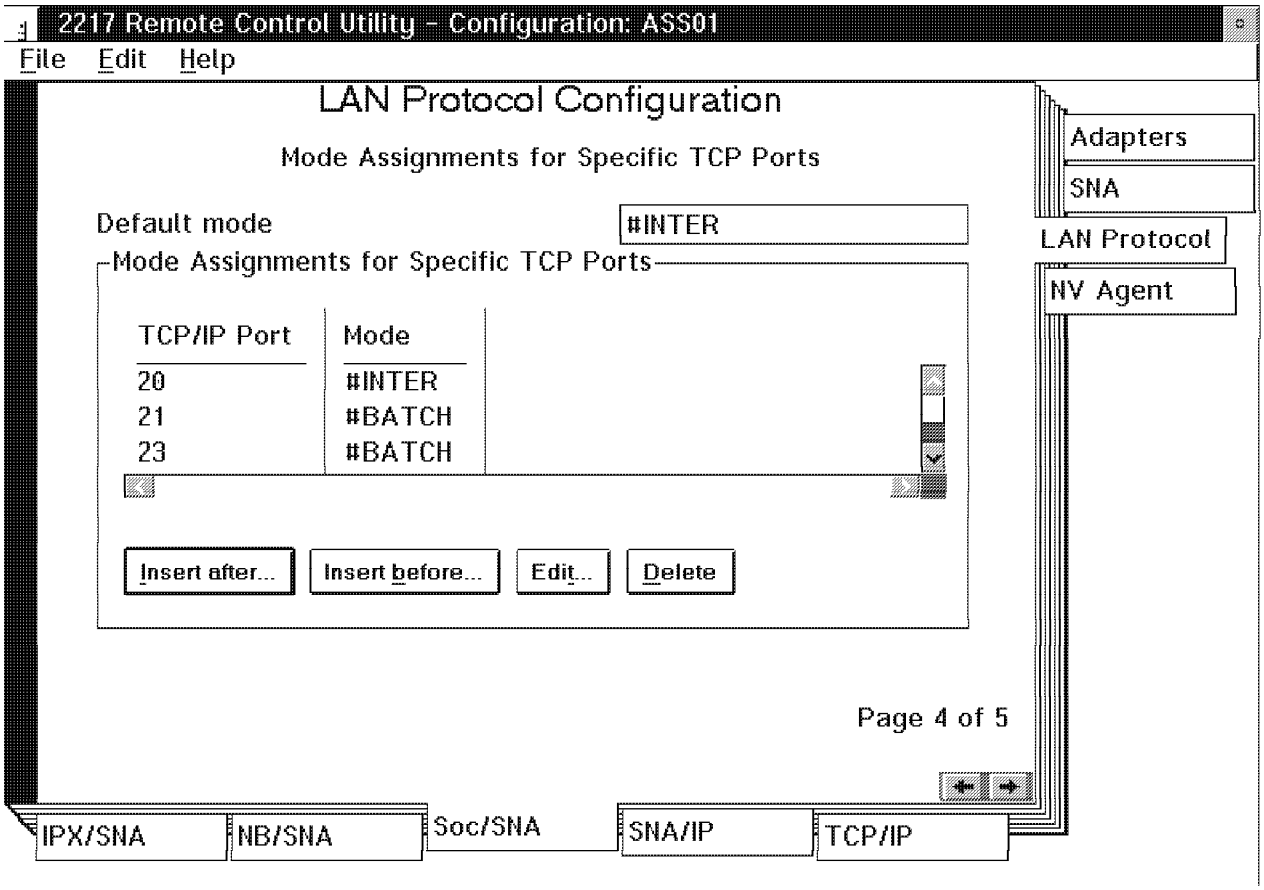


Figure 89. Mode Assignments for Specific Ports

5.1.6 Connecting TCP/IP Networks Using Sockets over SNA Gateway

Sockets over SNA Gateway is also useful for interconnecting separate native TCP/IP networks across an SNA network. For example, two Sockets Gateways can be used to connect two TCP/IP networks to an SNA network. In this network configuration, socket applications on either TCP/IP network can use the gateway to communicate with socket applications on the SNA network or with socket applications on the other remote TCP/IP network.

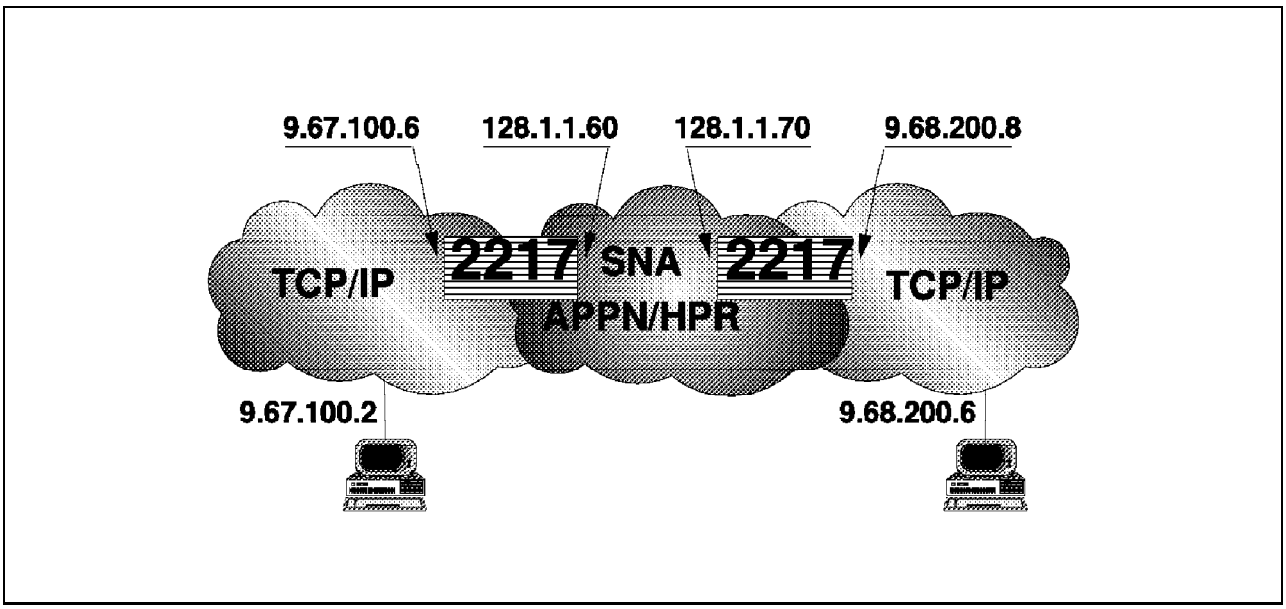


Figure 90. Connecting TCP/IP Networks over SNA

5.1.7 Connecting TCP/IP Networks Using VTAM Subarea

Sockets over SNA Gateway is also useful for interconnecting separate native TCP/IP networks across an SNA subarea network. For example, two or more IBM 2217 MpC Sockets over SNA Gateways can be used to connect TCP/IP networks to an SNA subarea network. In this network configuration, socket applications on either TCP/IP network can use the gateway to communicate with socket applications on the other remote TCP/IP network.

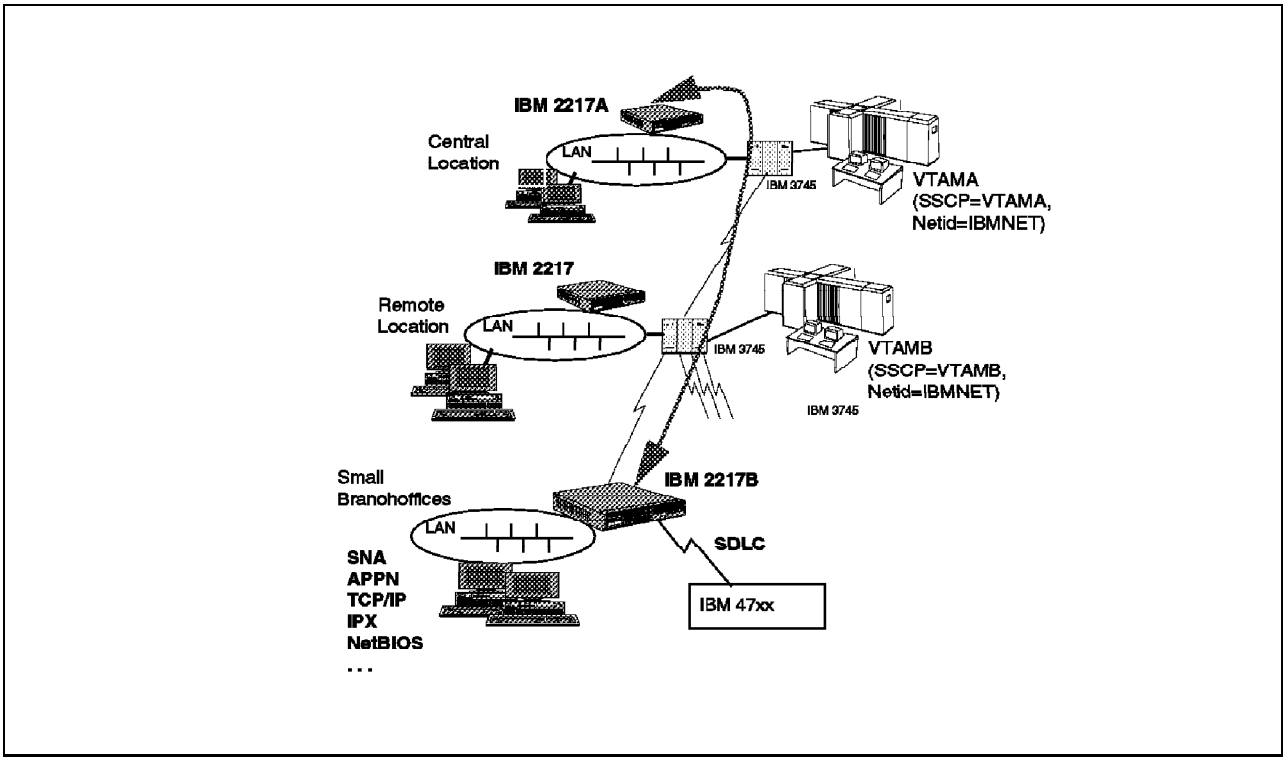


Figure 91. Connecting TCP/IP Networks over SNA Subarea

In this configuration, the IBM 2217 MpC uses a LEN connection to VTAM Subarea. Therefore, logical units (LUs) used by the IBM 2217 MpC for this function must be explicitly defined in the IBM 2217 MpC. In VTAM, the LUs are defined as independent LUs with NAU address 0 (zero).

Note

When using VTAM Subarea, the modes you are using for the APPC transport sessions must be available in the logmode table you are using.

5.1.8 Setting Up the TCP/IP Environment for Sockets over SNA Gateway

In order to have IBM 2217 MpC Gateway actually route data between an SNA network and a native IP network, you need an IP interface configured for TCP/IP to support the native IP part of the Sockets over SNA Gateway. You also need to configure system parameters for your TCP/IP host as determined by your TCP/IP environment, such as:

- Host name
- Domain name
- Name server address
- Default router address
- SNMP community

5.1.9 Defining an IP Network Interface for Sockets over SNA

In addition to an IP interface for native TCP/IP communication, the Sockets over SNA Gateway also requires an IP interface to the SNA network, which will be called SNA0.

In addition, Sockets over SNA Gateway will define a gateway loopback interface GW0. IBM 2217 MpC uses this interface to do address fixups on IP datagrams so that the original sender's IP address appears in the datagram, not the IP address of the gateway.

5.1.10 SNA Route Discovery Function

The route discovery function is provided by the IBM 2217 MpC Sockets over SNA Gateway and it requires no configuration. It routes TCP/IP traffic more efficiently and reduces the number of explicitly defined route statements in your network.

Initially, all nodes use a default router that notifies other nodes when a more direct route is discovered and this scheme is more efficient than using the typical TCP/IP solution of broadcasting routing information.

Note

To effectively use this function, algorithmic mapping of IP addresses to LU names and SNA APPN should be used. Otherwise, nodes must explicitly define LU names and IP addresses for all remote nodes with which they communicate.

For example, in the following illustration, IBM 2217 MpC A, B, and C are Sockets over SNA Gateways connected to IP LANs. These gateways connect the IP LANs to an APPN backbone network.

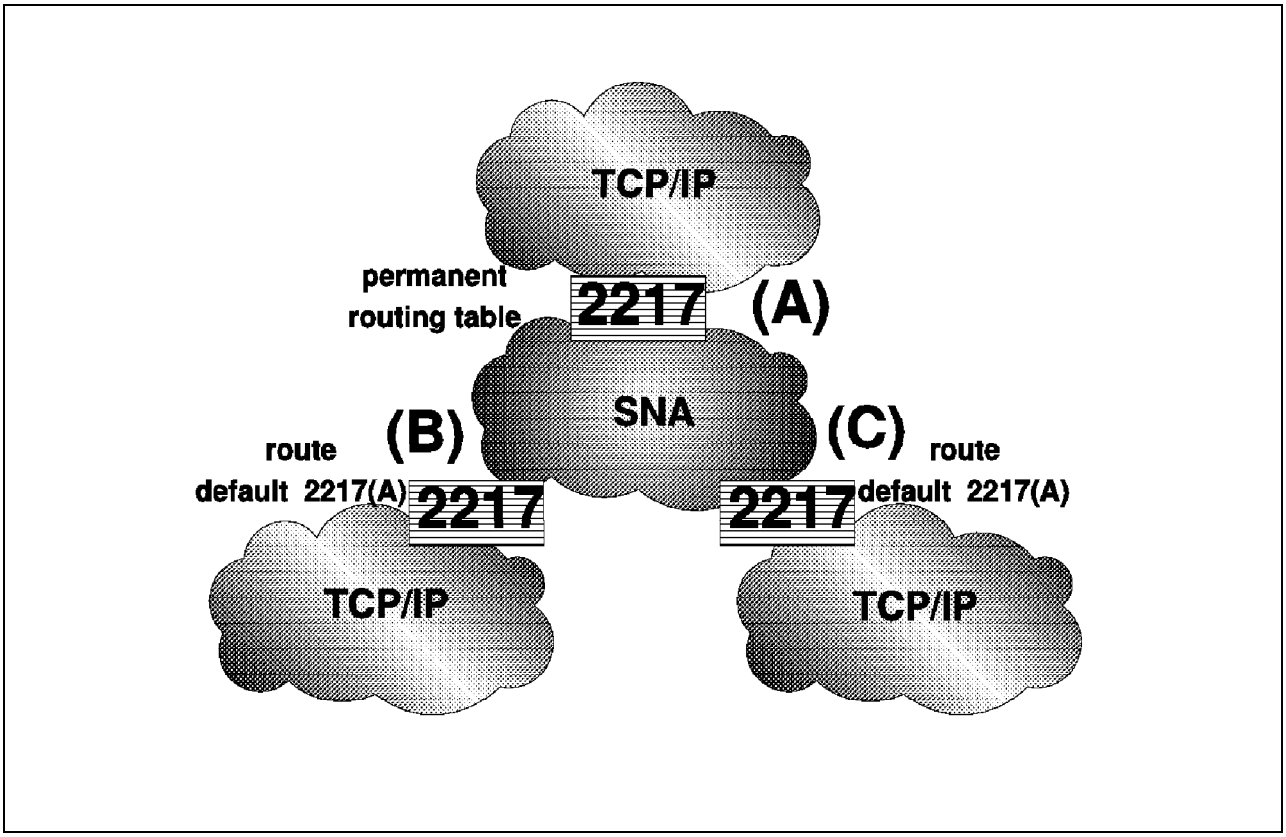


Figure 92. Routing Information Protocol (RIP)

In this configuration, IBM 2217 MpC A is the only gateway where you maintain a complete, permanent routing table. IBM 2217 MpC B and C define IBM 2217 MpC A as their default router. If a remote network or subnetwork is known to IBM 2217 MpC A, then B and C do not have to explicitly define these routes.

Also, when IBM 2217 MpC B and C route data to undefined networks or subnetworks, these requests are sent to their default router A.

If the network or subnetwork is known to IBM 2217 MpC A and a more direct path is available, IBM 2217 MpC A sends an ICMP redirect message back to the requester indicating the path to take in the future. This ICMP redirect message updates the requester's routing table. Therefore, IBM 2217 MpC B and C dynamically build their routing tables for remote networks and subnetworks as needed.

The Route Discovery function updates IP routing table entries for requester nodes located in SNA networks. To update routing entries for nodes in IP networks, you must select the Sockets over SNA option to enable RIP.

If new gateways are added, update the permanent routing table of IBM 2217 MpC A. No explicit route statements are needed in B and C.

In the routing table, route entries added by ICMP redirect messages contain a D in the flags column. This indicates that the route entry was created dynamically.

5.1.11 Routing Information Protocol (RIP)

IBM 2217 Nways MpC Release 2.0 has included RIP support. The RIP option provided by IBM 2217 MpC uses the routing functions provided by the TCP/IP gated program. If you select this option, the IBM 2217 MpC can update routing table entries for nodes in IP networks when more direct routes are discovered.

Note

All nodes in the IP network must enable RIP for this to occur.

The RIP option updates IP routing table entries for requester nodes located in IP networks. Routing entries for nodes in SNA networks are updated by the IBM 2217 MpC Sockets over SNA Route Discovery function.

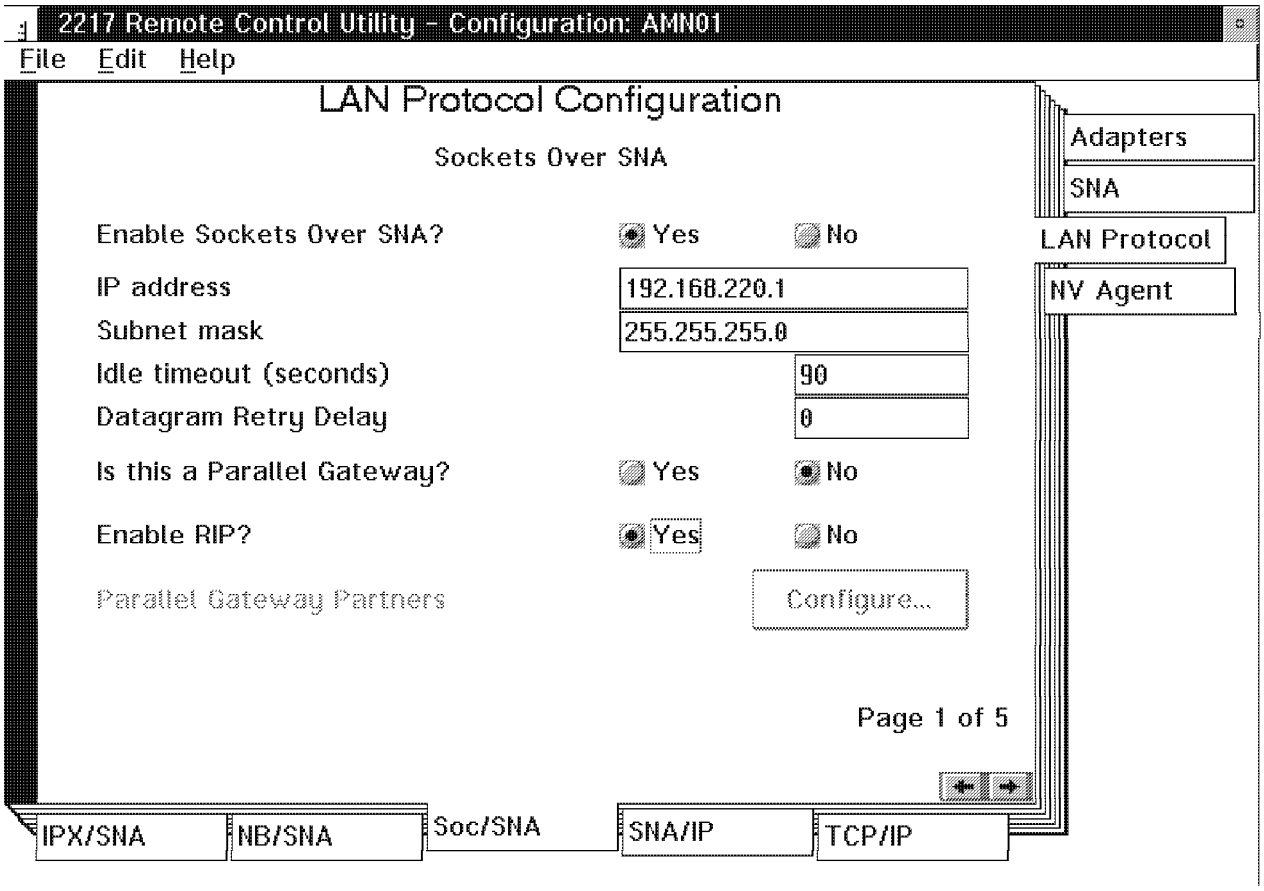


Figure 93. Routing Information Protocol (RIP) - Configuration

5.1.12 Parallel Gateways

IBM 2217 Nways MpC Release 2.0 has included support of Sockets over SNA parallel gateways. The default is that the Sockets over SNA Gateway is not a parallel gateway. To use this function, you must select the option in the Sockets over SNA local panel for Sockets over SNA. In addition, you also need to define routes to all remote subnets.

Note

The RIP option is automatically selected when you select the parallel gateway option.

Using parallel gateways in a central site provides:

- Backup, so that connectivity is assured even if one of the gateways fails
- Load balancing, so that traffic is routed even if a single gateway is not powerful or fast enough to handle its traffic at peak times

Other remote gateways define default routes to each of the parallel gateways.

Note

Parallel gateways use the Routing Information Protocol (RIP) to monitor the status of other partner parallel gateways. By using RIP, parallel gateways are able to periodically broadcast the contents of their routing tables to partner parallel gateways when changes occur.

The following figure illustrates a network configuration using parallel Sockets over SNA Gateways in order to provide backup and load balancing to a TCP/IP network.

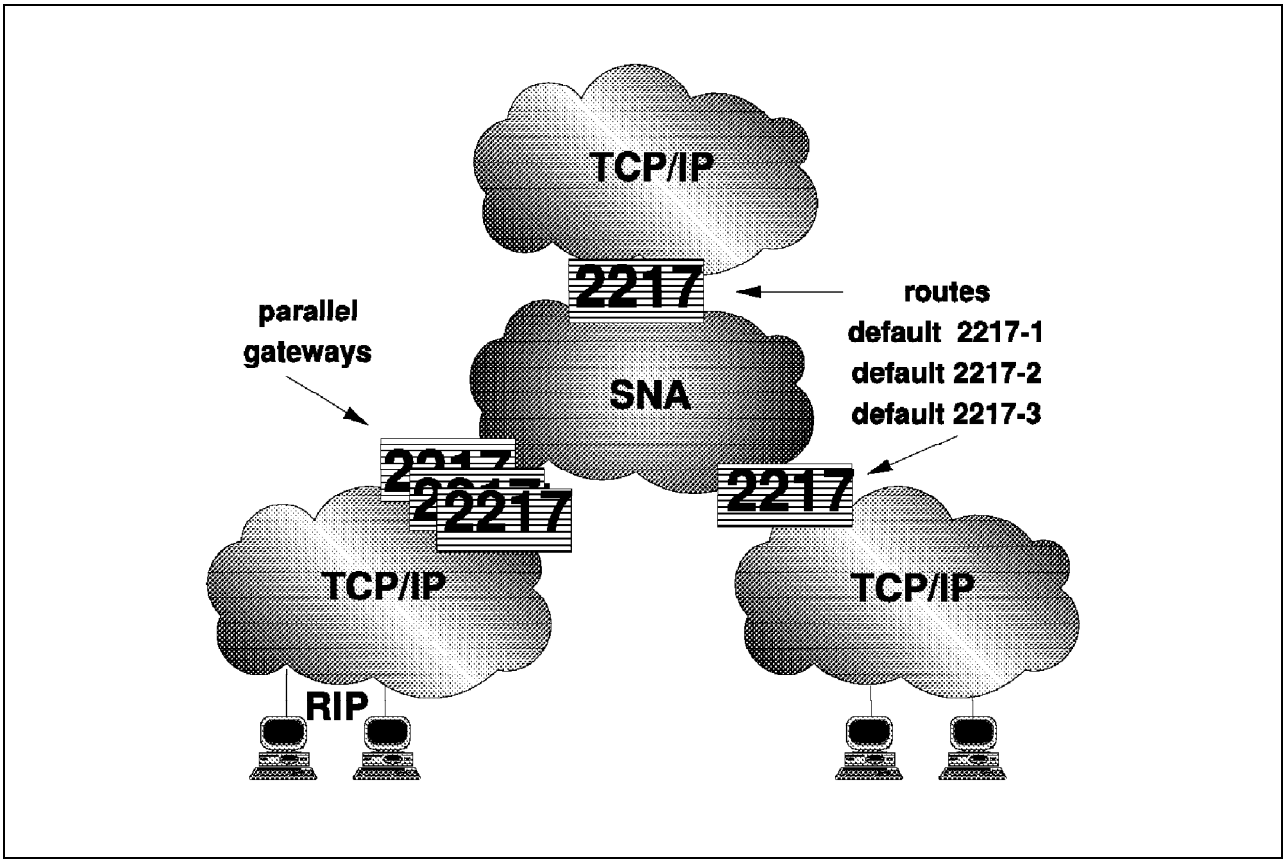


Figure 94. IBM 2217 MpC Sockets over SNA Parallel Gateways

In this example:

- Nodes attached to the IP network must be running the TCP/IP routed or gated programs to receive updates from IBM 2217 MpC Sockets over SNA parallel gateways. These programs use the Routing Information Protocol (RIP).
- Other remote Sockets over SNA Gateways must explicitly define default routes to the IBM 2217 MpC Sockets over SNA parallel gateways.
- Initially, traffic is distributed evenly among Sockets over SNA parallel gateways. This partitioning is done by the parallel gateways during startup.
- If an IBM 2217 MpC Sockets over SNA Gateway fails, the other parallel gateways take over the remote networks for the gateway that failed.
- When a gateway fails, connection-oriented applications must be restarted. Connectionless applications continue to run, but data will be discarded until the backup gateway takes control.
- When a gateway that previously failed recovers and it is again operational, it eventually regains control of its remote sites.
- When the original gateway recovers, applications running through a backup gateway continue to run until completion. For applications that run a long time, it is possible that the original gateway cannot regain control until the application is stopped or the remote gateway is restarted.

5.2 Sockets over SNA Gateway: Configuration

Before actually performing the task of configuration, you should already be familiar with IP-LU address mapping, and you should know the required address parameters for the system you are going to configure.

Configuration for Sockets over SNA Gateway is performed from within Configuration Notebook in the IBM 2217 MpC RCU.

The primary purpose in RCU configuration is to set up the IP-LU mapping table and specify which SNA service modes are to be used for Sockets over SNA.

Note

For SNA subarea connections (LEN nodes), you need to define a link and partner LUs for each remote Sockets over SNA node you want to communicate with.

5.2.1 Sockets over SNA Gateway Configuration

In this section, we show what is required to configure Sockets over SNA support in the IBM 2217 MpC.

5.2.1.1 Sockets over SNA - Local Node

The following table explains what you need to configure in the Sockets over SNA Local panel.

Table 6. Sockets over SNA Configuration - Local Node

Setting	Meaning
Enable Sockets over SNA	Select **Yes** to use this function.
IP Address for SNA	Enter the local IP address that you want to use for your Sockets over SNA Gateway.
Subnet mask	Enter the local IP subnet mask to determine what addresses can be reached in the SNA network.
Idle timeout (seconds)	Enter a timeout value to terminate a datagram conversation if not in use (default is 90 seconds).
Datagram Retry Delay	Specifies time in seconds to retry SNA allocates.
Is this a Parallel Gateway?	Select parallel gateways for backup and load balancing.
Enable RIP	Specify to use the routing information protocol (RIP) on LAN0.

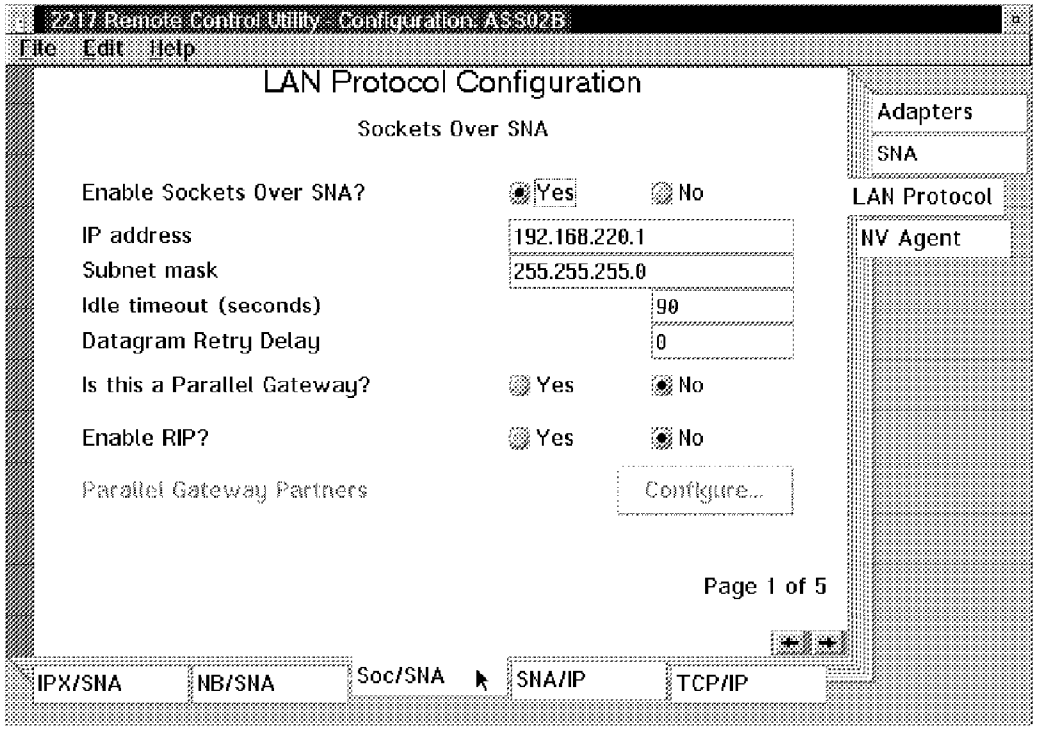


Figure 95. Local Definitions

In this example, the subnet mask is 255.255.255.0 which means that the bits from the first three bytes of the IP address will be used. That is, the SNA subnet is really 128.1.1 and the nodes in this network have IP addresses 128.1.1.1 to 128.1.1.255 except for the reserved addresses such as the broadcast IP address.

5.2.1.2 Explicit Address Mappings

The following table explains what you configure in the Explicit Address Mappings panel.

Note

Ignore this section if you are only using algorithmic address mappings.

Table 7. Sockets over SNA Configuration - Explicit Address Mappings

Setting	Meaning
IP Address	Enter the IP address of your local node or remote node you want to communicate with using Sockets over SNA Gateway.
Network ID	Enter the network ID for the SNA network.
LU Name	Enter the LU name you want to use for the remote node.

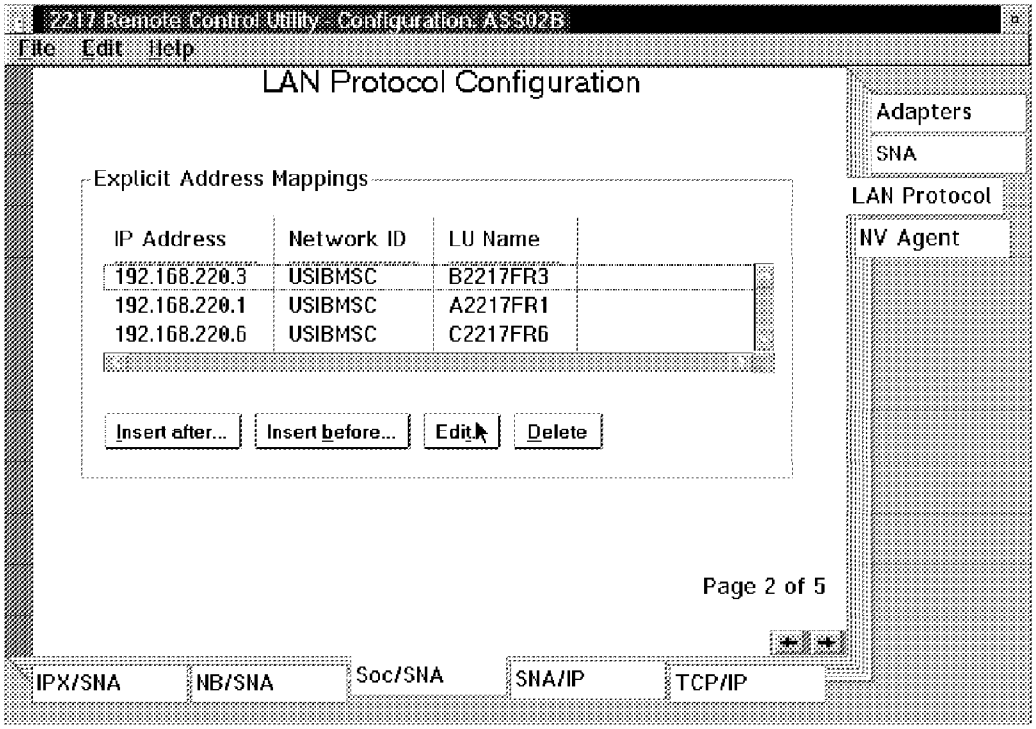


Figure 96. Explicit Address Mappings

In this definition for explicit address mappings, there are three entries as follows:

- IP address 192.168.220.3 maps into LU name USIBMSC.B2217FR3.
- IP address 192.168.220.1 maps into LU name USIBMSC.B2217FR1.
- IP address 192.168.220.6 maps into LU name USIBMSC.C2217FR6.

5.2.1.3 Algorithmic Address Mappings

The following table explains what you configure in the Algorithmic Address Mappings panel.

Table 8. Sockets over SNA Configuration - Algorithmic Address Mappings	
Setting	**Meaning**
IP Address	Enter the IP subnet address of your SNA network. The address mask selects what bits are used. Other bits are ignored.
Address Mask	Enter the address mask you want to use for your SNA network.
Network ID	Enter the network ID for the SNA network.
LU Template	Enter the suffix that will be used to create the LU name.

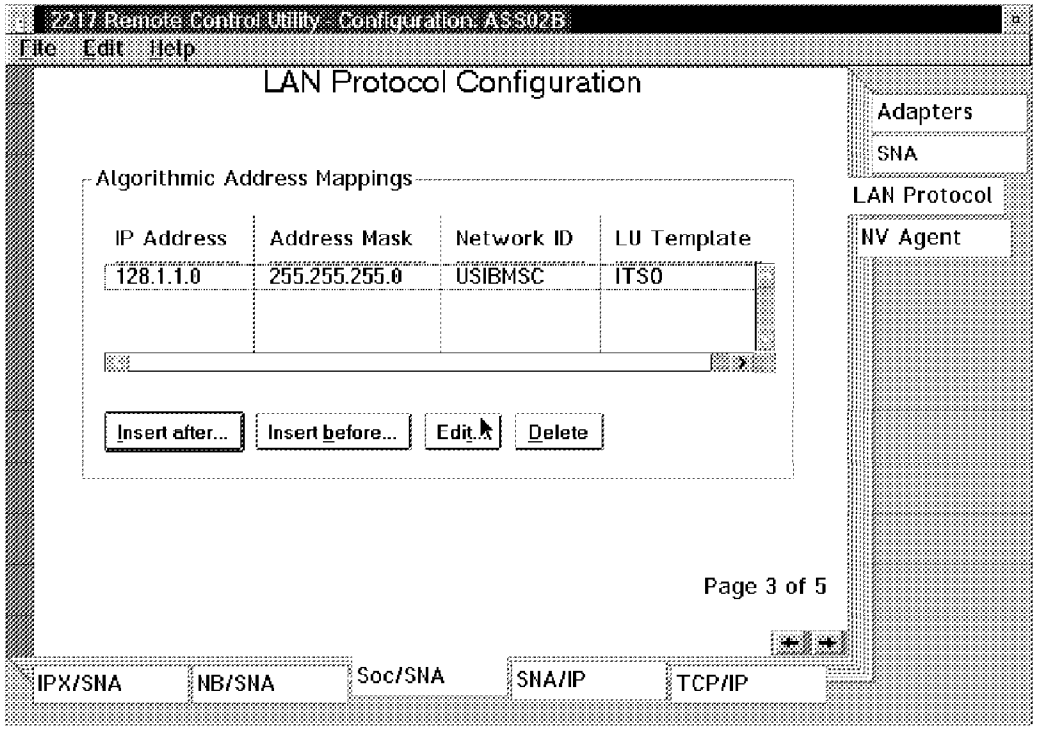


Figure 97. Algorithmic Address Mappings

In this definition for algorithmic address mappings we show you some results for a few values:

- IP address 128.1.1.1 maps into LU name USIBMRA.ITSC0001.
- IP address 128.1.1.3 maps into LU name USIBMRA.ITSC0003.
- IP address 128.1.1.7 maps into LU name USIBMRA.ITSC0007.
- IP address 128.1.1.20 maps into LU name USIBMRA.ITSC000M.
- IP address 128.1.1.100 maps into LU name USIBMRA.ITSC0034.

5.2.1.4 Routes

You only need to configure routes when you need to access remote nodes in other TCP/IP networks connected to another Sockets over SNA Gateway.

The following table explains what you need to configure in the Routes panel.

Table 9. Sockets over SNA Configuration - Routes	
Setting	**Meaning**
Route Type	Enter default, host (node), net or subnet.
Route Destination	Leave blank if type default. Otherwise, enter the host or net or subnet address.
Router Address	Enter the Sockets over SNA Gateway IP address in the SNA network.
Metric	Number of hops (nodes) to destination node.

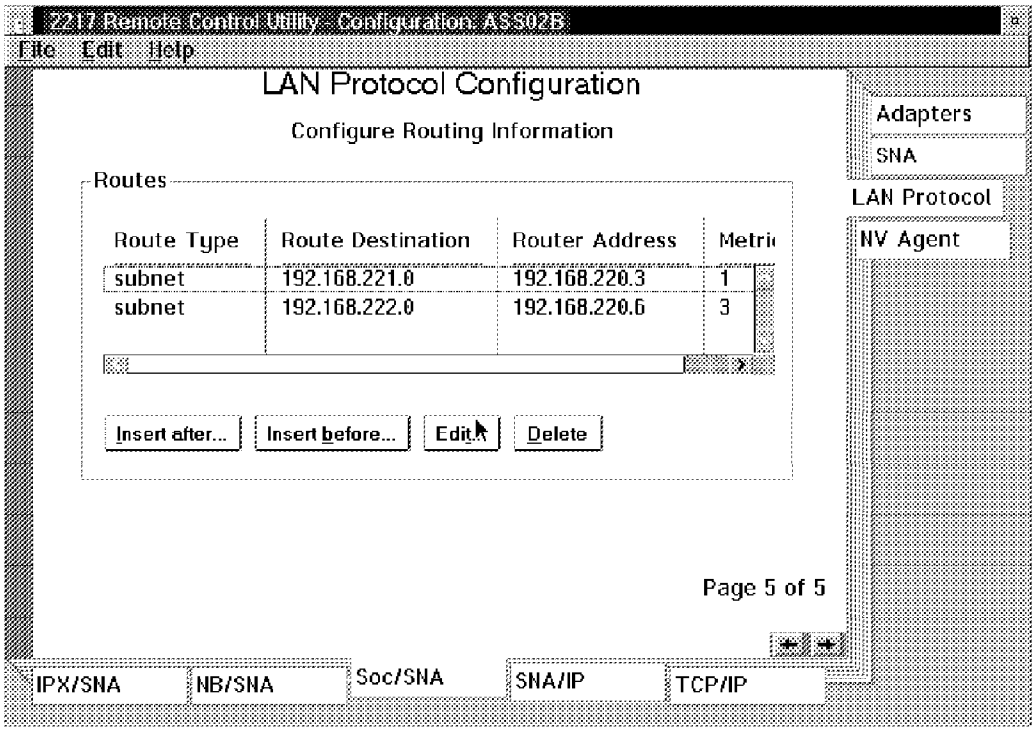


Figure 98. Routes

In this definition for a route, data for subnet 192.168.221.0 will be routed to 192.168.220.3 and data for subnet 192.168.222.0 will be routed to 192.168.220.6.

5.2.1.5 TCP/IP Configuration for Sockets over SNA Gateway

In the RCU, select **TCP/IP** to start your configuration.

In this configuration, you enter the IP address interface for LAN0 and the subnet mask you are using if one is required. In this example, the LAN0 address interface is 9.24.104.2 and the subnet mask we are using is 255.255.255.0.

Note

You should always enable the TCP/IP LAN0 interface for the IBM 2217 MpC you are configuring.

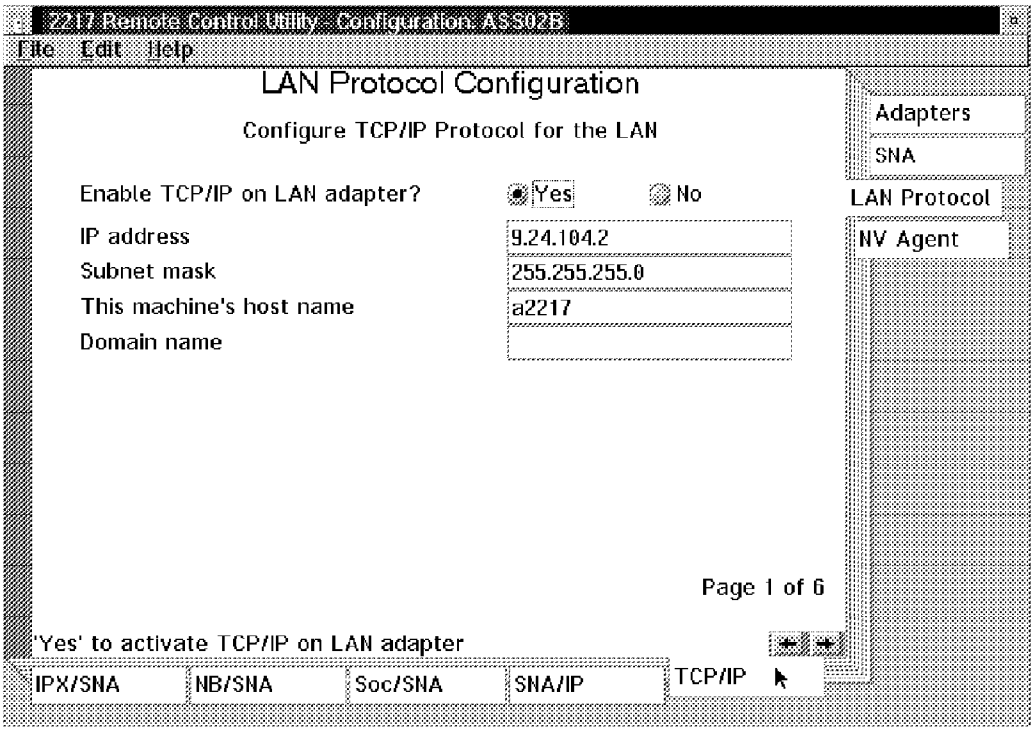


Figure 99. Sockets over SNA Gateway - TCP/IP Configuration (Network)

Caution!

The IBM 2217 Nways MpC Release 2.0 does not support variable subnetting. Therefore, the same subnet mask must be used for the SNA0 and LAN0 interfaces.

5.2.2 TPC/IP Workstation Configuration

In this section, we show you a sample configuration in order to support TCP/IP in your workstation.

5.2.2.1 TCP/IP Configuration - Network

In the configuration of TCP/IP for the workstation, enter the IP address and the subnet mask. For example:

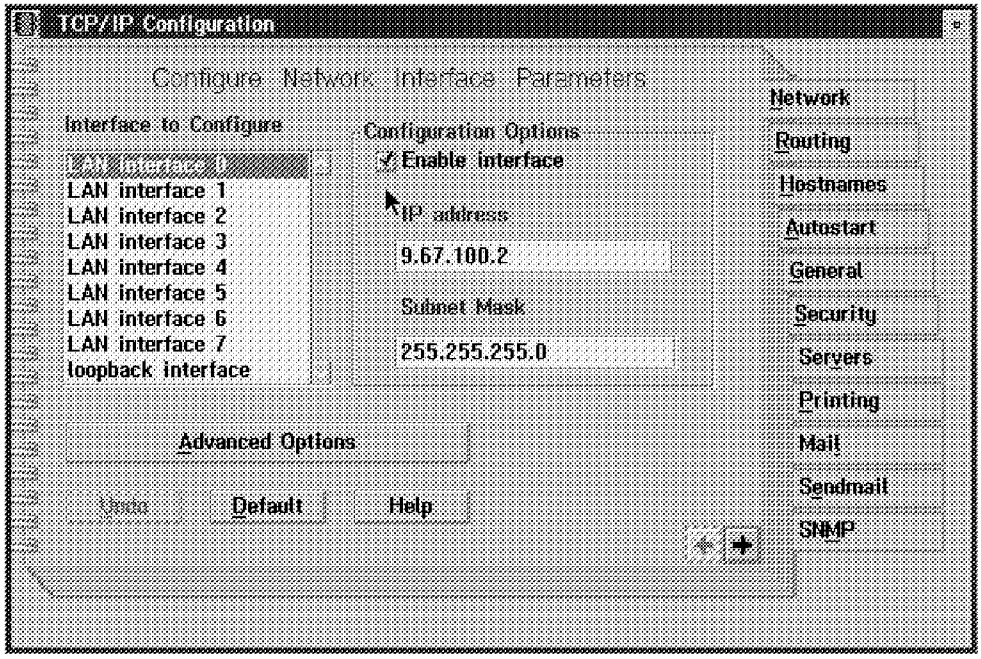


Figure 100. TCP/IP Workstation - Network

5.2.2.2 TCP/IP Configuration - Route Entry

In order to access sockets applications in the SNA network, you need to specify this in the Route Entry panel. In this example, we are indicating that requests targeting a workstation with IP address 128.1.1.X should be routed to IBM 2217 MpC with IP address interface 9.67.100.7. The metric is 1 indicating that it is not in the local network and one hop is required (the IBM 2217 MpC Sockets over SNA Gateway).

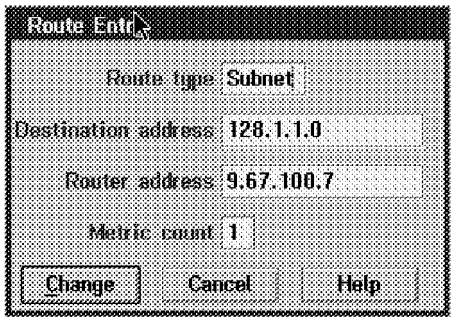


Figure 101. TCP/IP Workstation - Routing

5.3 Scenario 1: A Single IBM 2217 MpC Sockets over SNA Gateway

In this scenario, an IBM 2217 MpC is configured as a Sockets over SNA Gateway in order to connect an SNA network to a TCP/IP network. Access nodes A and B are connected to the SNA network and access nodes X and Y are connected to a TCP/IP network. The SNA subnet is 128.1.1 and the TCP/IP subnet is 9.67.100. This is because in both cases the address mask is 255.255.255.0.

Note

In IBM 2217 Nways MpC Release 2.0, SNA and TCP/IP subnets must use the same subnet mask.

The IBM 2217 MpC has an IP address interface 128.1.1.7 to the SNA network (SNA0) and 9.67.100.7 to the IP network (LAN0). Also, in the SNA network, the IP address 128.1.1.7 maps into MYNET.ITSC0007 LU name when using algorithmic address mappings.

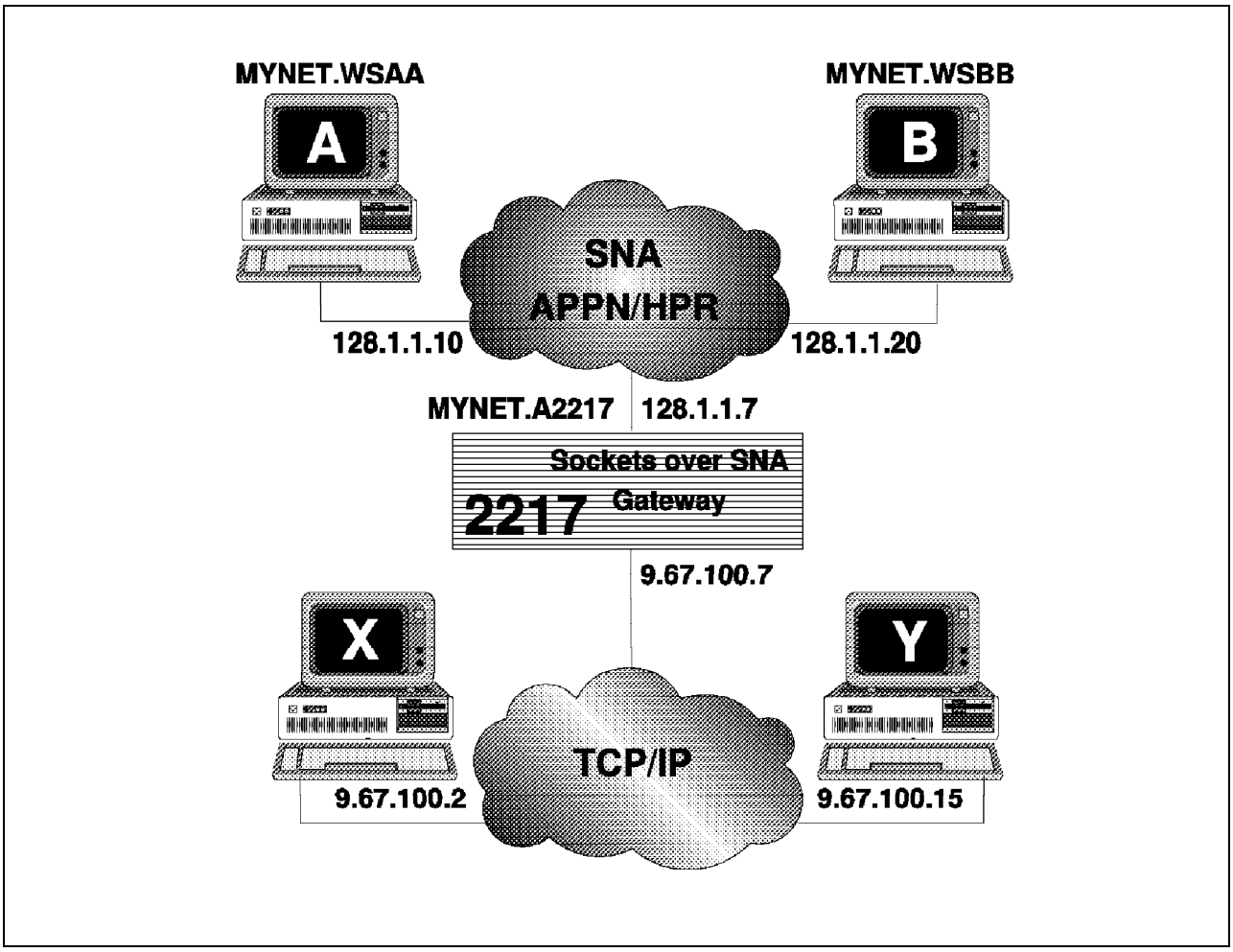


Figure 102. IBM 2217 MpC Sockets over SNA Gateway

For the scenario shown in Figure 102, we next show you the required configuration values:

- **Workstation A:**

- Local Sockets over SNA:
  - IP address: 128.1.1.10
  - Subnet mask: 255.255.255.0
- Algorithmic Address Mappings:
  - IP address: 128.1.1.0
  - Address mask: 255.255.255.0
  - Network ID: MYNET
  - LU template: ITSC
- Routes:
  - Route Type: default. It routes all traffic, not intended for the SNA network, to the IBM 2217 MpC.
  - Route Destination: Not used when type is default.
  - Router Address: 128.1.1.7 (IBM 2217 MpC).
  - Metric: 1.

• **Workstation B:**
- Local Sockets over SNA:
  - IP address: 128.1.1.20
  - Subnet mask: 255.255.255.0
- Algorithmic Address Mappings:
  - IP address: 128.1.1.0
  - Address mask: 255.255.255.0
  - Network ID: MYNET
  - LU template: ITSC
- Routes:
  - Route Type: default. Route all traffic, not intended for the SNA network, to the IBM 2217 MpC.
  - Route Destination: Not used when type is default.
  - Router Address: 128.1.1.7 (IBM 2217 MpC).
  - Metric: 1.

• **IBM 2217 MpC:**
- Local Sockets over SNA:
  - IP address: 128.1.1.7
  - Subnet mask: 255.255.255.0
- Algorithmic Address Mappings:
  - IP address: 128.1.1.0
  - Address mask: 255.255.255.0
  - Network ID: MYNET
  - LU template: ITSC
- TCP/IP Configuration:

        - IP address: 9.67.100.7
        - Subnet mask: 255.255.255.0
    - Routes:
        - None required. IBM 2217 MpC has direct access to both networks (SNA and TCP/IP).

- **Workstation X:**
    - TCP/IP Configuration - Network:
        - IP address: 9.67.100.2
        - Subnet mask: 255.255.255.0
    - TCP/IP Configuration - Route Entry:
        - Route type: Subnet
        - Destination Address: 128.1.1.0 (SNA subnet)
        - Router Address: 9.67.100.7 (IBM 2217 MpC)
- **Workstation Y:**
    - TCP/IP Configuration - Network:
        - IP address: 9.67.100.15
        - Subnet mask: 255.255.255.0
    - TCP/IP Configuration - Route Entry:
        - Route type: Subnet
        - Destination Address: 128.1.1.0 (SNA subnet)
        - Router Address: 9.67.100.7 (IBM 2217 MpC)

5.3.1 Testing Your Configuration

You should now be able to PING any workstation from a workstation in either the SNA or TCP/IP network. In other words, you can now run Sockets applications in your mixed networks.

For example, in workstation X, enter:

```
PING 9.67.100.2 (itself)
PING 9.67.100.15 (Y)
PING 9.67.100.7 (IBM 2217 MpC LAN0)
PING 128.1.1.7 (IBM 2217 MpC SNA0)
PING 128.1.1.10 (WSAA)
PING 128.1.1.20 (WSBB)
```

You may also want to PING the other nodes from WSAA and WSBB in the SNA network.

5.4 Scenario 2: Connecting TCP/IP Networks via APPN

In this scenario, we connect two TCP/IP networks using APPN. In order to reach nodes in other TCP/IP networks, the Sockets over SNA access nodes must include a route for the traffic to these nodes.

Also notice that in this configuration, we do not include the required SNA local node and SNA link definitions.

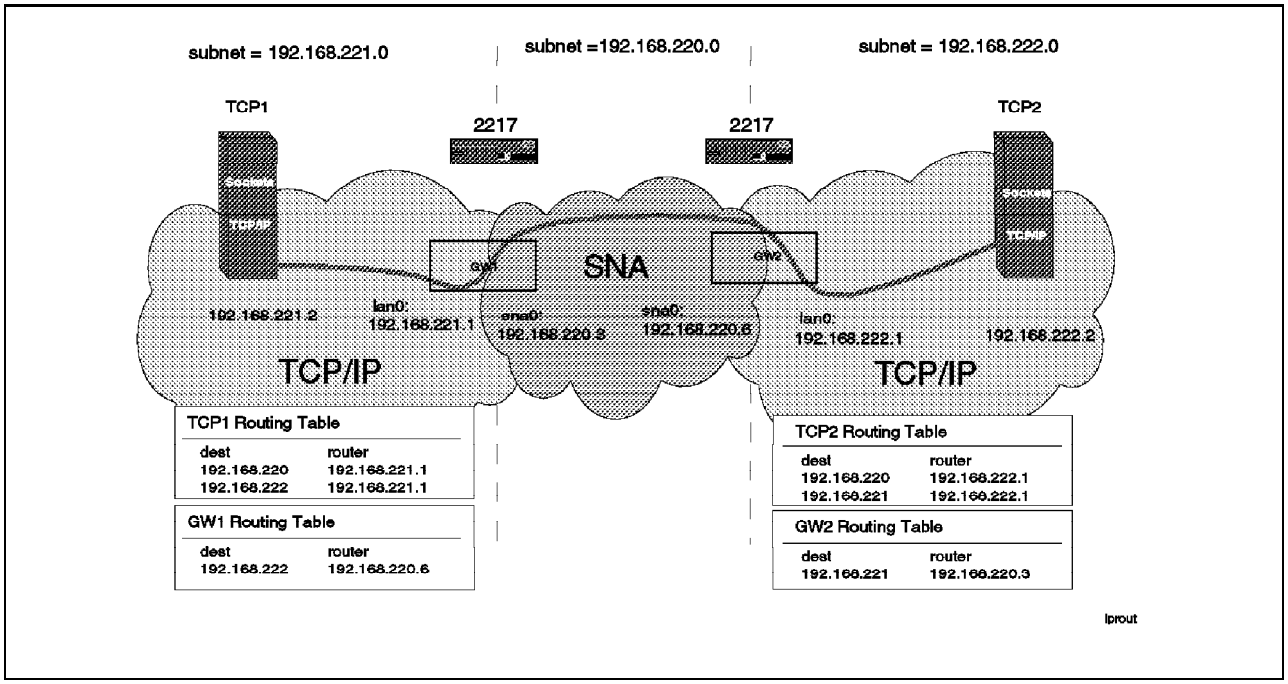


Figure 103. Multiple Sockets over SNA Gateways

- **Workstation TCP1:**
  - TCP/IP Configuration - Network:
    - IP address: 192.168.221.2
    - Subnet mask: 255.255.255.0
  - TCP/IP Configuration - Route for 192.168.220:
    - Route type: subnet
    - Destination Address: 192.168.220.0
    - Router Address: 192.168.221.1
  - TCP/IP Configuration - Route for 192.168.222:
    - Route type: subnet
    - Destination Address: 192.168.222.0
    - Router Address: 192.168.221.1
- **IBM 2217 MpC GW1:**
  - Local Sockets over SNA:
    - IP address: 192.168.220.3
    - Subnet mask: 255.255.255.0

- Algorithmic Address Mappings:
  - IP address: 192.168.220.0
  - Address mask: 255.255.255.0
  - Network ID: MYNET
  - LU template: LUX
- Modes:
  - Change default mode to MYMODE.
- Route Entry:
  - Route type: subnet
  - Destination Address: 192.168.222.0
  - Router Address: 192.168.220.6
  - Metric: 1
- TCP/IP Configuration:
  - IP address: 192.168.221.1
  - Subnet mask: 255.255.255.0

- **IBM 2217 MpC GW2:**
  - Local Sockets over SNA:
    - IP address: 192.168.220.6
    - Subnet mask: 255.255.255.0
  - Algorithmic Address Mappings:
    - IP address: 192.168.220.0
    - Address mask: 255.255.255.0
    - Network ID: MYNET
    - LU template: LUX
  - Modes:
    - Change default mode to MYMODE.
  - Route Entry:
    - Route type: subnet
    - Destination Address: 192.168.221.0
    - Router Address: 192.168.220.3
    - Metric: 1
  - TCP/IP Configuration:
    - IP address: 192.168.222.1
    - Subnet mask: 255.255.255.0
- **Workstation TCP2:**
  - TCP/IP Configuration - Network:
    - IP address: 192.168.222.2
    - Subnet mask: 255.255.255.0

- TCP/IP Configuration - Route for 192.168.220:
    - Route type: subnet
    - Destination Address: 192.168.220.0
    - Router Address: 192.168.222.1
- TCP/IP Configuration - Route for 192.168.221:
    - Route type: subnet
    - Destination Address: 192.168.221.0
    - Router Address: 192.168.222.1

5.4.1 Testing Your Configuration

You should now be able to PING any workstation from a workstation in either TCP/IP network. In other words, you can now run Sockets applications over SNA.

For example, in workstation TCP1, enter:

```
PING 192.168.221.2 (itself)
PING 192.168.221.1 (GW1 LAN0)
PING 192.168.220.3 (GW1 SNA0)
PING 192.168.220.6 (GW2 SNA0)
PING 192.168.222.1 (GW2 LAN0)
PING 192.168.222.2 (TCP2)
```

You may also want to PING the other nodes from TCP2 and so on.

5.5 Scenario 3: Connecting TCP/IP Networks via VTAM Subarea

In this scenario, two IBM 2217 MpCs are used to connect two TCP/IP networks via a VTAM Subarea network. Node A is connected to TCP 128.1.0 subnet and node B is connected to TCP 128.1.6 subnet. Both 2217s have an LEN connection to VTAM Subarea and the objective is to run client/server Sockets applications between nodes X and Y.

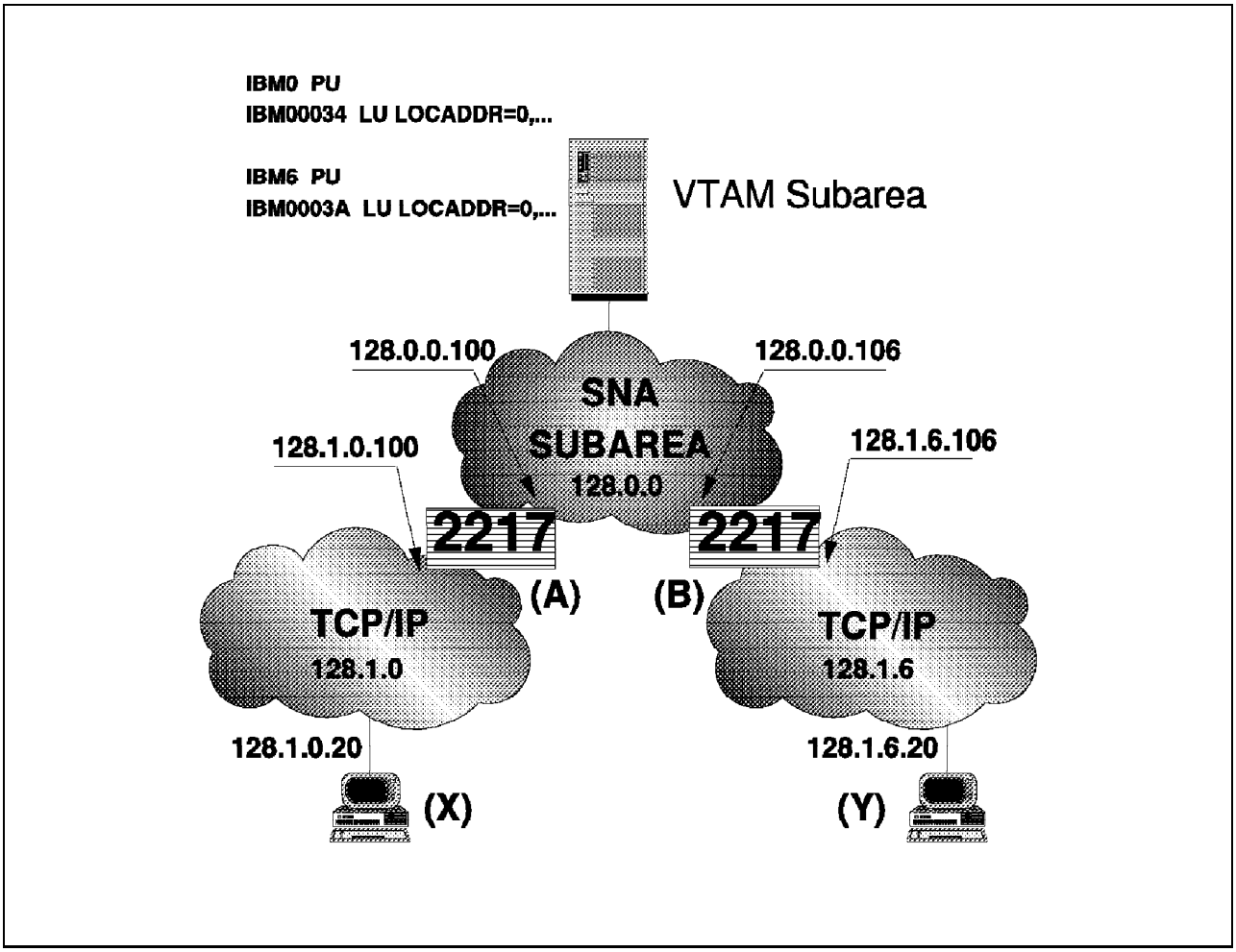


Figure 104. Sockets over SNA Gateway (Subarea)

5.5.1 Configuration

For this configuration, we assume the following values:

- VTAM fully qualified CP name is MYNET.VTAM01.
- Algorithmic mappings will be used.
- Subnet mask is 255.255.255.0.

Caution!

The IBM 2217 Nways MpC Release 2.0 does not support variable masks. Therefore, the same subnet mask must be used for the SNA0 and LAN0 interfaces.

- Network ID is MYNET.
- LU Template (prefix) is IBM.

> **Note**
>
> Because we are using algorithmic mappings, you can use the RCU Operations and Administration panels to generate and display the required partner LU names you need to define in VTAM. In this configuration, IP address 128.0.0.100 maps into MYNET.IBM00034 and IP address 128.0.0.106 maps into MYNET.IBM0003A.
>
> The alternative is to use explicit mappings and in this case, you define the LU names.

- When defining partner LU locations, partial wildcards will be used.
- IBM 2217 MpC will be LEN connected to VTAM subarea.
- **Workstation X:**
  - TCP/IP Configuration - Network:
    - IP address: 128.1.0.20
    - Subnet mask: 255.255.255.0
  - TCP/IP Configuration - Route Entry:
    - Route type: default
    - Destination Address: Not used
    - Router Address: 128.1.0.100
- **IBM 2217 MpC A:**
  - Local Sockets over SNA:
    - IP address: 128.0.0.100
    - Subnet mask: 255.255.255.0
  - Algorithmic Address Mappings:
    - IP address: 128.0.0.0
    - Address mask: 255.255.255.0
    - Network ID: MYNET
    - LU template: IBM
  - Modes:
    - Change default mode to MYMODE.
  - Route Entry:
    - Route type: subnet
    - Destination address: 128.1.6.0
    - Router address: 128.0.0.106
    - Metric: 1
  - TCP/IP Configuration:
    - IP address: 128.1.0.100
    - Subnet mask: 255.255.255.0

- SNA Links:
  - VTAM CP name is MYNET.VTAM01
  - Define a LEN connection to VTAM01
- Define Partner LU (location):
  - Wildcard entry: Partial
  - Partner LU: MYNET.IBM (partial wildcard)
  - Adjacent CP name: MYNET.VTAM01

- **IBM 2217 MpC B:**
  - Local Sockets over SNA:
    - IP address: 128.0.0.106
    - Subnet mask: 255.255.255.0
  - Algorithmic Address Mappings:
    - IP address: 128.0.0.0
    - Address mask: 255.255.255.0
    - Network ID: MYNET
    - LU template: IBM
  - Modes:
    - Change default mode to MYMODE.
  - Route Entry:
    - Route type: subnet
    - Destination address: 128.1.0.0
    - Router address: 128.0.0.100
    - Metric: 1
  - TCP/IP Configuration:
    - IP address: 128.1.6.100
    - Subnet mask: 255.255.255.0
  - SNA Links:
    - VTAM CP name is MYNET.VTAM01
    - Define a LEN connection to VTAM01
  - Define Partner LU (location):
    - Wildcard entry: Partial
    - Partner LU: MYNET.IBM (partial wildcard)
    - Adjacent CP name: MYNET.VTAM01
- **Workstation Y:**
  - TCP/IP Configuration - Network:
    - IP address: 128.1.6.20
    - Subnet mask: 255.255.255.0
  - TCP/IP Configuration - Route Entry:

- Route type: default
- Destination address: Not used
- Router address: 128.1.6.106

- **VTAM definitions:**
  - Define PU: IBM0 (2217-A).
  - In IBM0, define LU: IBM00034 with locaddr=0, using mode table with MYMODE.
  - Define PU: IBM6 (2217-B).
  - In IBM6, define LU: IBM0003A with locaddr=0, using mode table with MYMODE.
  - Define mode MYMODE in log mode table.

5.5.2 Testing Your Configuration

You should now be able to PING workstation Y from workstation X and vice versa. In other words, you can now run Sockets applications between TCP/IP 128.1.0 and 128.1.6 subnets.

For example, in workstation X, enter:

```
PING 128.1.0.20 (itself)
PING 128.1.0.100 (IBM 2217 MpC A - LAN0)
PING 128.0.0.100 (IBM 2217 MpC A - SNA0)
PING 128.0.0.106 (IBM 2217 MpC B - SNA0)
PING 128.1.6.106 (IBM 2217 MpC B - LAN0)
PING 128.1.6.20 (Y)
```

You may also want to PING workstation X from workstation Y in order to test your configurations.

5.5.3 Troubleshooting

When troubleshooting, you may use the following hints:

- PING

  This is the normal PING command you submit on any workstation to test reachability of the partner TCP/IP host. Be aware that you always need a route defined for both directions. If you only have a route in one direction, the connection will fail.

- Remote PING

  You can send a PING command via the RCU panel (Operations - TCP/IP) on a 2217. This is helpful to determine on which part of a TCP/IP network the routing definitions are missing or are inconsistent.

- GWSTAT

  With this command, you are able to check the status of the Sockets over SNA support. This function is available via RCU panel (Operations - Sockets over SNA) to display active connections.

  As an example see the following display of an active FTP session. For FTP you always have two connections (one port for session management data, and one for FTP data) on Port 21 and Port 20.

```
  ID    Proto      Native endpoint         MPTN endpoint  Flags
-----------------------------------------------------------------
090029   TCP    192.168.221.2/ 1073      9.24.104.4/   20   00e2
07003e   TCP    192.168.221.2/ 1071      9.24.104.4/   21   0114
```

Note

You will never see a connection for PING because PING is neither a UDP nor a TCP application. PING uses the ICMP protocol.

For more details (that is, number of transferred bytes) you can display a specific connection with its corresponding connections IDs. For example:

```
ID:                          07003e
Protocol:                       TCP
Native endpoint:   192.168.221.2/ 1071
MPTN endpoint:       9.24.104.4/   21
Idle time:               170 seconds
Flags:                         0114
   inbound MPTN connection exists
   inbound native connection exists
   outbound native connection exists
Bytes sent native to MPTN:         57
Bytes sent MPTN to native:        240
```

```
ID:                          090029
Protocol:                       TCP
Native endpoint:   192.168.221.2/ 1073
MPTN endpoint:       9.24.104.4/   20
Idle time:                85 seconds
Flags:                         00e2
   non-native initiated connect
   connection in CLOSEWAIT state
   have received MPTN SO_TERM
   have sent MPTN SO_TERM
Bytes sent native to MPTN:          0
Bytes sent MPTN to native:        349
```

- SNA status

  You may also check the status of the SNA logical links, which are a prerequisite to get the Sockets over SNA sessions up. The following display is an example of the SNA logical links with active Sockets over SNA connections.

```
     Link        DLC           Partner
     Name     Name   #      FQName     Type  HPR Sess     State
    -------- -------- - ---------------- ----- --- ---- ---------------
*   TOC2217  IBMTRNET 2 USIBMSC.C2217     NN    RTP 2    Active
*   @ANYGW   $ANYNET  0 $ANYNET.$GWCP     LEN      0    Active
*   @AAAAAAA IBMTRNET 0 USIBMSC.CPPCB     EN    RTP 3    Active
*   TOA2217  IBMTRNET 1 USIBMSC.A2217     NN    RTP 4    Active
    LINK0001 SDLC     0                        0    Inactive
```

- Tracing

Traces will help you to detect and isolate a connectivity problem. From the RCU panels, you can set traces on any IBM 2217 MpC.

Part 4. LAN Applications

Chapter 6. NetBIOS Applications over SNA

In this chapter, we describe a configuration in order to run NetBIOS applications over SNA. This chapter complements Part 6, "The 2217 Support for NetBIOS over SNA" of the *IBM 2217 Nways MpC User's Guide, Release 2*. It is not intended to replace the information provided there. In fact, you will find a lot of valuable information, especially in the planning chapter.

6.1 How Does the IBM 2217 MpC Transport NetBIOS Frames over SNA?

The IBM 2217 MpC allows for two completely different ways to transport NetBIOS frames between LANs:

- Using frame relay source route bridging (SRB)
- Using AnyNet technology (NetBIOS over SNA)

Source route bridging is normally disabled for NetBIOS traffic by default and the recommended way to carry NetBIOS traffic over an SNA link is implemented in the NetBIOS over SNA Gateway function of the IBM 2217 MpC. When an IBM 2217 MpC connects to another IBM 2217 MpC, they use APPC sessions to exchange data. When two 2217s are configured for NetBIOS over SNA, one pair of APPC sessions is used to carry the traffic between the NetBIOS/SNA (and IPX/SNA) Gateways. The NetBIOS over SNA Gateways then listen for NetBIOS frames that match the configured name qualifiers, convert them into SNA format (using the IEEE 802.2 protocol stack), and send them on one of the APPC sessions to the partner 2217. The second session is used to receive data.

The 2217 also takes care of NetBIOS-specific requirements, such as the need to acknowledge the delivery of a particular frame to its originating workstation.

The NetBIOS/SNA Gateway in the 2217 interacts and is compatible with:

- IBM AnyNet LAN Gateway program
- IBM LAN-to-LAN-over-WAN (LTLW) program

Note

The IBM 2217 MpC NetBIOS/SNA Gateway is not able to interact with the IBM AnyNet NetBEUI over SNA program.

6.2 Scenario Description

The following scenario will be configured in order to run NetBIOS applications over SNA:

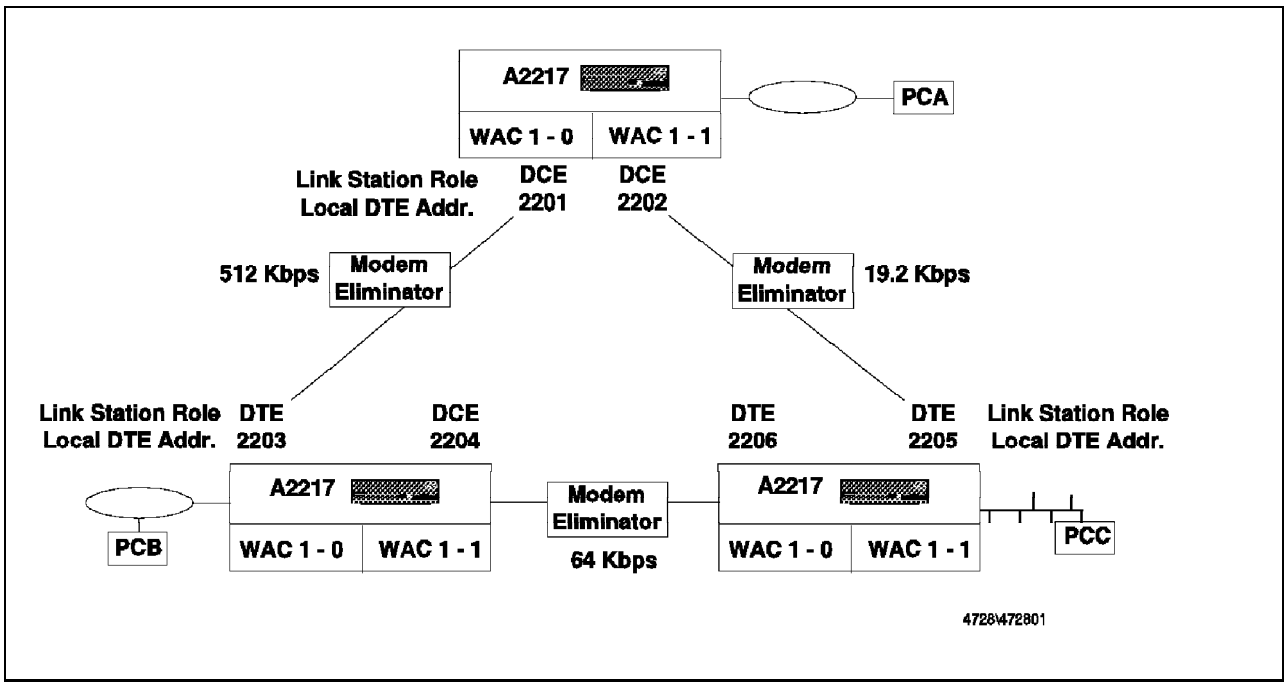


Figure 105. NetBIOS over SNA Using X.25

In this configuration, the wide area link (an X.25 packet-switched network in this case) was substituted by modem eliminators. However, this approach gives us the flexibility to experiment with different line speeds.

While testing the NetBIOS/SNA Gateway functionality, we aimed at proving the NetBIOS routing capabilities, using various NetBIOS applets and applications (including the OS/2 LAN Requester, DCAF and the LANXCOPY utility program). We did not try to achieve maximum performance in our setup, nor did we try to experiment with a representative selection of other NetBIOS applications.

We document the SNA and NetBIOS-specific options of the configuration for the 2217-A in the following sections of this chapter; the configurations for 2217-B and C were set up accordingly. The X.25 related part of the configuration is documented in Chapter 9, “X.25 Data Link Control - Configuration” on page 205.

6.3 Sample Configuration

A configuration for the 2217 to allow for the transport of NetBIOS frames over an SNA network has to include at least the following information:

- Adapter configuration (LAN and WAC, see Chapter 1, “Introduction” on page 3)
- SNA network information (Links, DLCs, LUs, etc.)
- LAN protocol information (Links to other LANs, Filters, etc.)

In the following sections, we focus on the SNA and LAN aspects of this configuration.

6.3.1 SNA Network Configuration

The information contained in this section is similar to the one provided in other chapters of this redbook. For the sake of readability we included it here again.

In this scenario, we decided to present a configuration using an X.25 link between the 2217s. However, other types of WAN connectivity could be used (that is, SDLC or frame relay). In this chapter, we leave out the X.25 related profiles. For information on how to configure for X.25, please see Chapter 9, "X.25 Data Link Control - Configuration" on page 205. For information on how to configure for SDLC, see Chapter 8, "SDLC Data Link Control - Configuration" on page 193. For information on how to configure for frame relay, see Chapter 10, "Frame Relay and Source Route Bridging" on page 221.

6.3.1.1 SNA Local Node Characteristics

You must define the SNA local node characteristics before any other configuration profiles. Figure 106 shows an example of the configuration panel for the SNA local node characteristics.

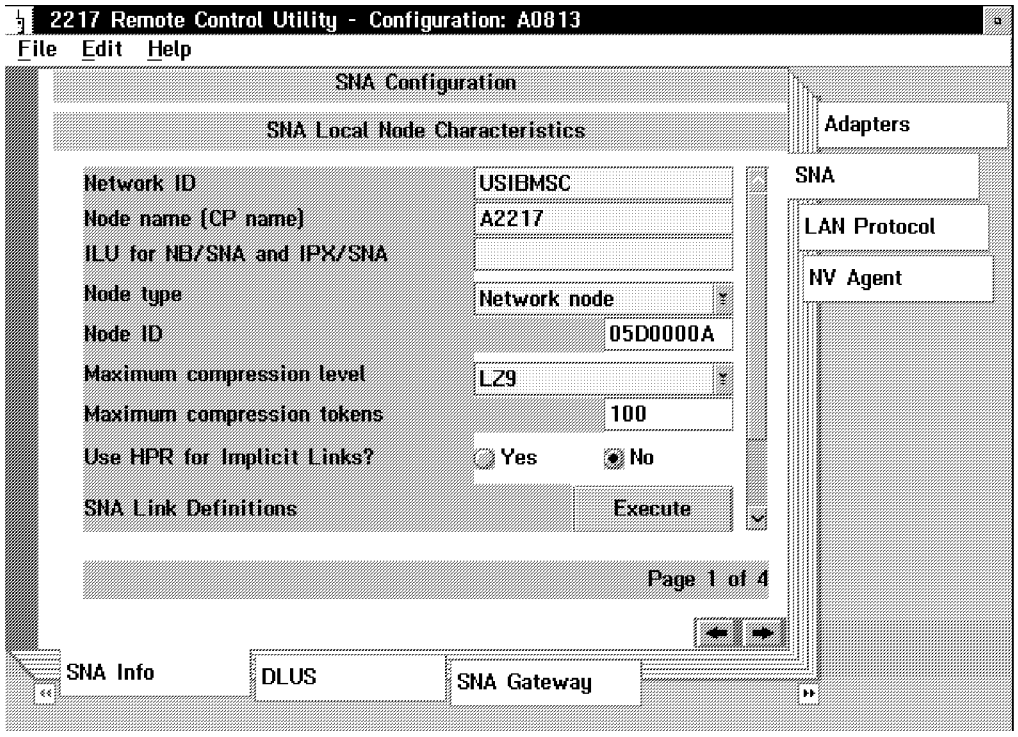


Figure 106. SNA Local Node Characteristics

There are a couple of decisions you will have to make even at this early stage:

- Do you want the NetBIOS/SNA and IPX/SNA Gateways to use the same local LU.
- Should the 2217 be an APPN end node or network node.

Here is a short discussion of the entry fields that you will find on this panel:

- To begin the configuration, you will first take care of the basic SNA characteristics of the 2217, that is, you will provide the network name and node name (CP name is a term you might be more familiar with) of the machine.

- **ILU for NB/SNA and IPX/SNA:** You will probably allow the NetBIOS/SNA and IPX/SNA Gateway function to use the implicit independent LU associated with the CP name, so you will leave the entry field for this LU name blank.
- For the Node type, you will probably change the default end node to network node to enable the 2217 to do Intermediate Session Routing (ISR) as well as HPR Automatic Network Routing (see Chapter 2, “SNA Enhancements” on page 19 for further information).
- **Node ID:** Enter the IdBlk/IdNum here, if required.
- **Maximum compression level:** If you want to make use of the SNA data compression algorithms (for example, when connecting to another 2217, a 3745 Communications Controller or an AS/400), you have to configure for this in two different places. The first place is here. You may chose either the RLE or the LZ9 compression. We recommend using compression on slower links (less than 128 kbps) in general, and using the LZ9 algorithm.
- **Maximum compression tokens:** If you configure for compression, you also have to predetermine the maximum number of tokens that the SNA data compression feature will be able to use. If you are able to predetermine the number of sessions that will use SNA data compression, you may calculate the number of tokens required. See the *IBM 2217 Nways MpC User's Guide, Release 2* for more information on how to do this.
- **Use HPR for implicit links?:** This allows (prevents) HPR to be used with non-predefined, implicit links.
- **SNA Link Definitions:** Here you will have to configure all SNA links. We explain this in more detail in the following section.
- **Enable Host Focal Point Support?:** This basically determines where you want management services data to be sent (to an SNA host system, or to be stored locally).
- **Alert Focal Point Link Name:** As you may have only one link that can be used to transmit management services data, you will have to specify the name of this link here. Otherwise, the 2217 would not be able to determine which link to use for this task.

6.3.1.2 SNA Links

When you click on **Execute** next to SNA Link Definitions as shown in Figure 106 on page 147, you will get a panel which gives an overview of the SNA links as included in the current configuration.

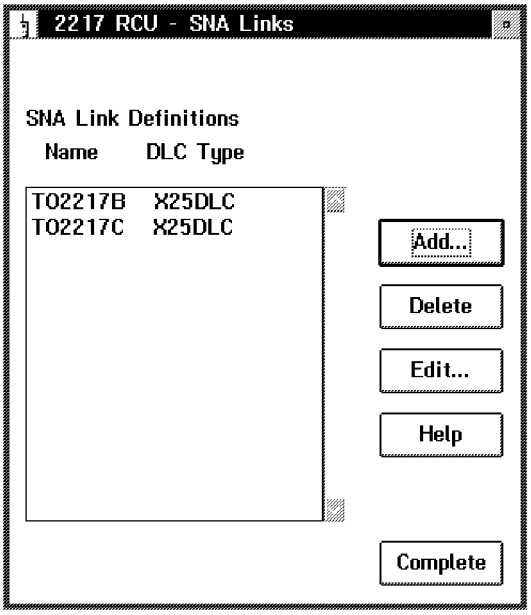


Figure 107. 2217 RCU - SNA Links

When you click on **Add** or **Edit**, you may specify the detail information for a particular link. See Figure 108 and Figure 109 on page 150 for an example of the definitions for the link to 2217-B. The link to 2217-C was defined identically. Figure 107 gives an example of this panel.

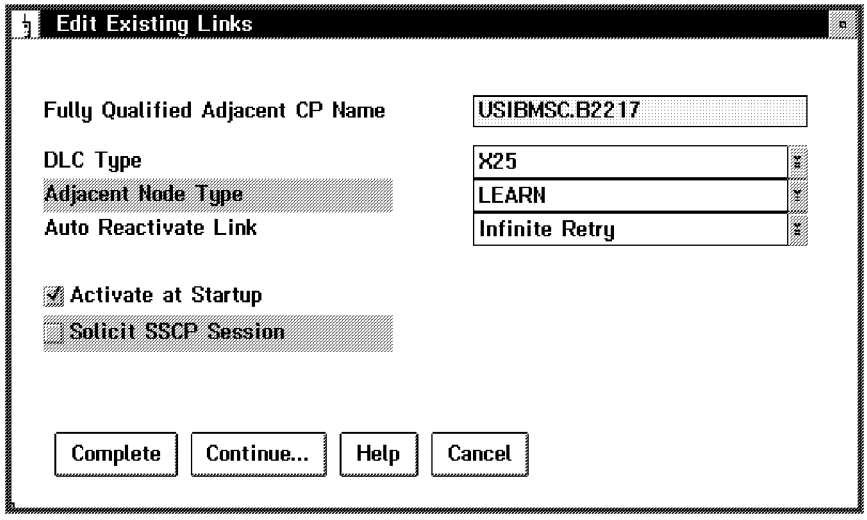


Figure 108. Link to 2217-B

The link definition consists of the following items:

- **Fully Qualified Adjacent CP Name:** This is the name of the partner node at the other end of the link (for example, YOURNET.YOURNODE).
- **DLC Type:** Select one of the following DLCs: Token Ring, Ethernet, SDLC, X.25 or Frame Relay.

- **Adjacent Node Type:** Select either LEARN, LEN or NN here, depending on what type of node your partner is. If in doubt, select LEARN. The default is LEN.
- **Auto Reactivate Link:** This defaults to NO RETRY. In an X.25 or SDLC configuration, we experienced problems during the verification of the configuration on the 2217 using NO RETRY, which resulted in error messages. Our recommendation is to set this parameter to INFINITE RETRY for X.25 (where you specified Permanent Request to Send = Yes in the WAC port settings) and SDLC nonswitched connections.
- **Activate at Startup:** By default, the 2217 will try to activate every specified link upon startup. If, for any reason, you do not want this to happen for a particular link, click off the check mark here.
- **Solicit SSCP Session:** If this option is marked, the 2217 will try to obtain an SSCP-PU session with the partner node. This is used only when the 2217 is configured for SNA Gateway, and the link being defined is the host link.

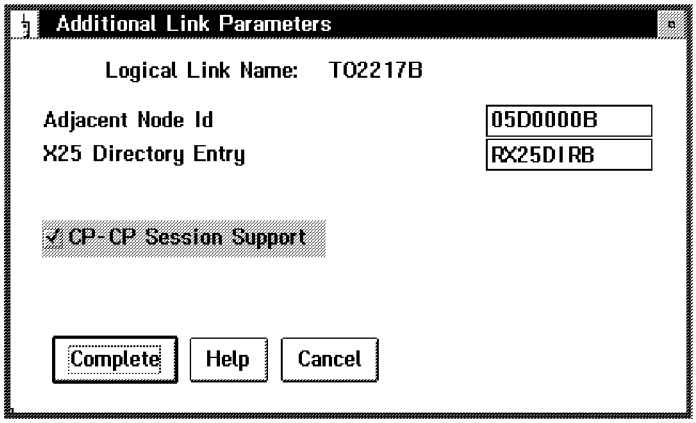


Figure 109. Additional Link Parameters.

The following items complete the link definition parameters:

- **Adjacent Node Id:** If you configure for several links, on which during link initialization the node ID is used for verification, you need to specify the partner's node ID here.
- **X.25 Directory Entry:** In this example, you need to specify the (Remote) X.25 directory entry here. Note that this panel may contain different entry fields when you configure another DLC.
- **CP-CP Session Support:** When you configure for a link to an APPN end node (that is, select Adjacent Node Type LEARN) or network node, CP-CP session support can be requested as an option. By default, only NNs have CP-CP sessions to each other, as well as ENs to their respective NN servers.

6.3.1.3 SNA Modes

On page 2 of the SNA configuration section, you will find information related to the modes that are employed for the APPC sessions between the 2217 and its partners. There is a number of modes supplied with each configuration by default. See Figure 110 for a sample configuration.

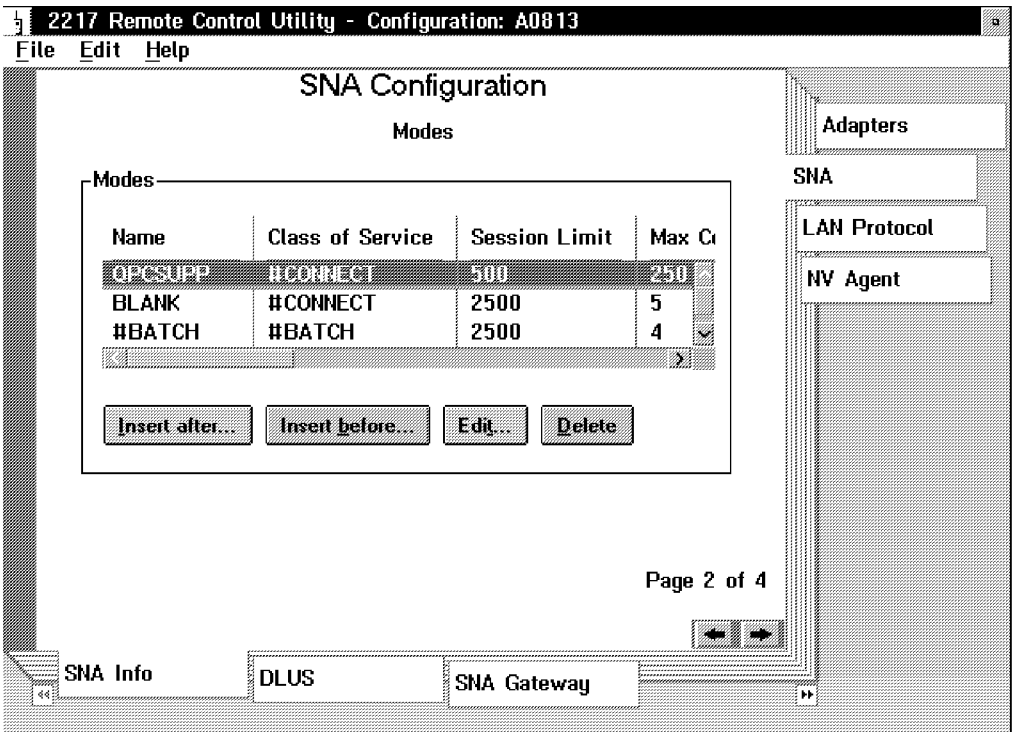


Figure 110. SNA Configuration - Modes

Each mode definition consists of various entries for the class of service (COS), the potential number of concurrent sessions between a pair of LUs using this mode, etc. These parameters have a distinct influence on the 2217s ability to set up and maintain APPC sessions. Therefore, it is recommended not to modify the already supplied modes, but to create additional modes, if required.

Note

Through different COS, the 2217 is able to support SNA transmission priority. However, it is not possible to modify the COS values through the RCU.

6.3.1.4 Other SNA Configuration Panels

Pages 3 and 4 in the SNA configuration section cover connection networks and partner LUs. As we do not need them in this configuration example, we skip the related panels at this point.

6.3.2 LAN Protocol Configuration Example

In the following section, we examine the profiles required for the NetBIOS/SNA Gateway. All of these can be found in the LAN Protocol section in the RCU notebook. To begin this part of the configuration, click on the **NB/SNA** tab at the bottom of the panel.

6.3.2.1 Parameters That Affect Memory Usage

As Figure 111 shows, there are a couple of parameters to be set for the NetBIOS/SNA Gateway to work properly. Default values will allow you to set up the gateway for reasonable performance in most cases.

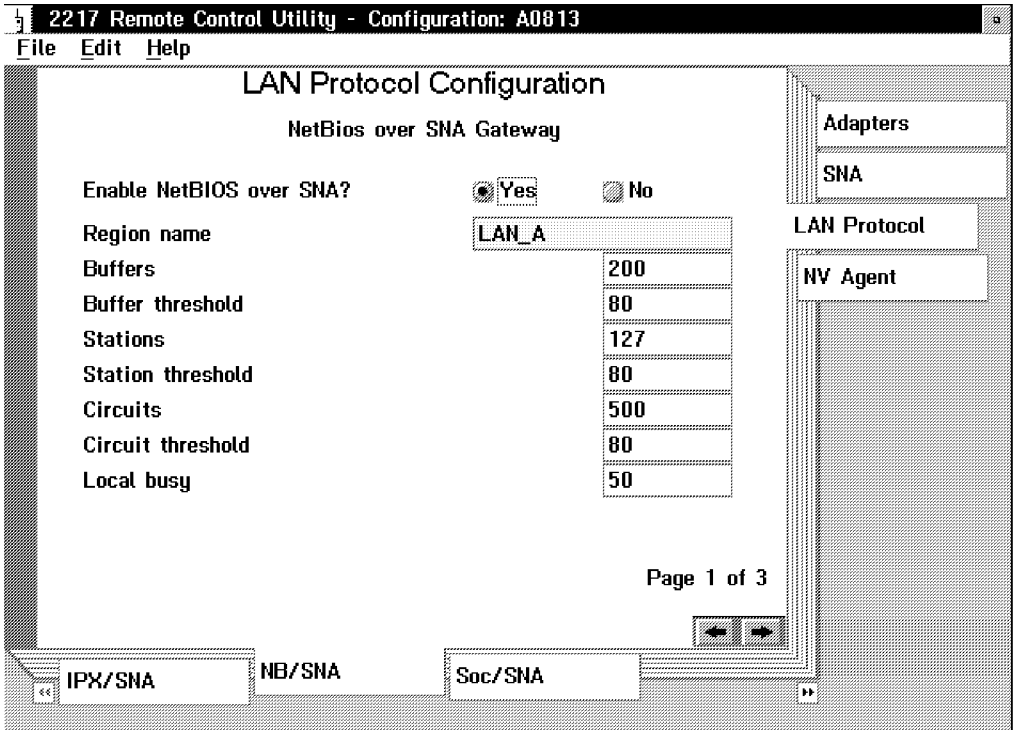


Figure 111. LAN Protocol Configuration - NetBIOS over SNA Gateway

The following is some additional information to consider:

- **Region name:** This name does not get across the WAN link. It is intended to be helpful in event reporting.
- **Buffers:** Defaults to 600. This value probably has to be increased only when you have more than 600 workstations on your local LAN. According to the *IBM 2217 Nways MpC User's Guide, Release 2*, setting the buffers value to 200 will be sufficient in most cases.
- **Buffer threshold:** When the percentage of buffers that you specify here is reached, the NB/SNA Gateway will log an entry in the AL2217.LOG, send out an SNA alert, and send an SNMP trap (if SNMP was configured).
- **Stations:** This is the maximum number of links to workstations on the local LAN that are supported concurrently through the NetBIOS/SNA Gateway. Although the maximum value for this parameter is 255 (being the maximum that the LAN adapter supports), it defaults to 127, which will be sufficient in most cases.
- **Station threshold:** Like the buffer threshold, this is a percentage value. If the 2217 NB/SNA Gateway usage reaches this value, an alert is logged and sent respectively.
- **Circuits:** This is the number of NetBIOS sessions between workstations on the local LAN and workstations on remote LAN that are supported concurrently. Note that a single workstation may have multiple NetBIOS circuits to one or more remote workstations.

- **Circuit threshold:** As above, this is a percentage value.
- **Local busy:** This is not a percentage value, but stands for the actual number of workstations in a wait state. When the value that you specify here is reached (that is, this number of workstations cannot get a NetBIOS connection over the WAN), the 2217 logs and sends out an alert.

6.3.2.2 Partner Gateway Information

Figure 112 and Figure 113 on page 154 show the configuration panels for the 2217's partner NetBIOS/SNA (and IPX/SNA) Gateways.

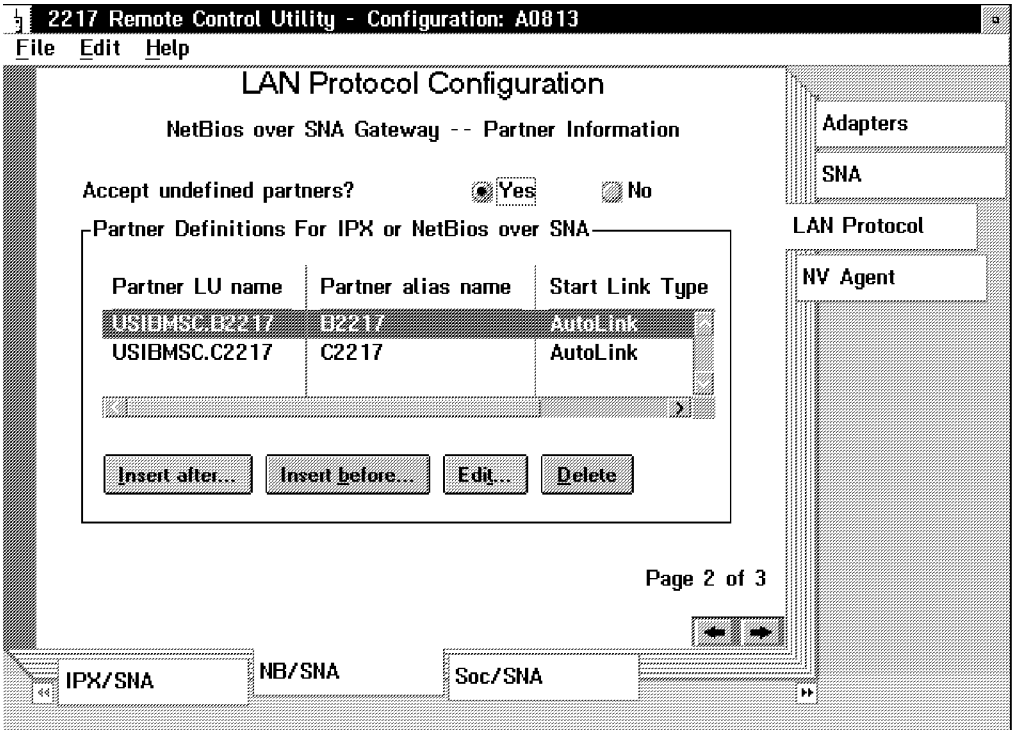
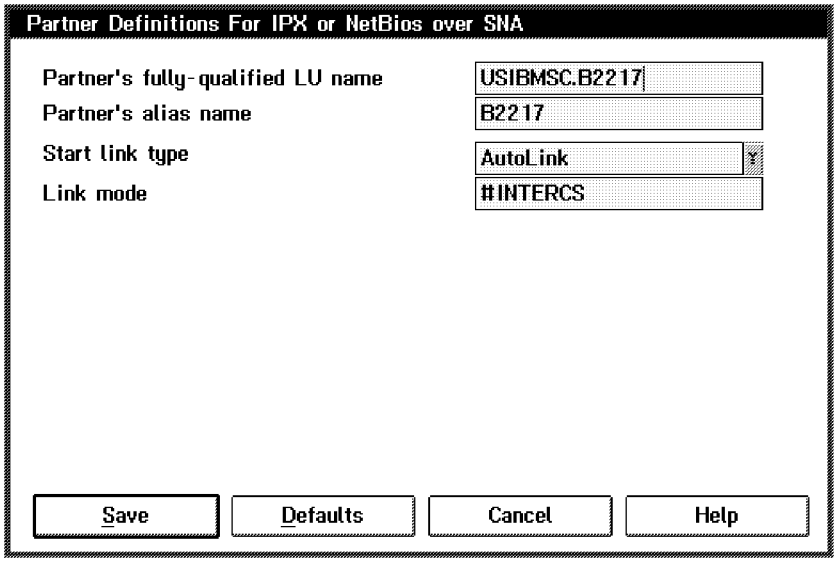


Figure 112. NetBIOS over SNA Gateway - Partner Information Overview Panel

In most cases, you will determine the connections between gateways by defining the respective partner LUs (that represent other gateways) in each gateway.

In fact, you need to define the LU that is used by the partner NetBIOS/SNA Gateway rather than a route, as the gateway relies on the 2217's (APPN) capabilities to establish an SNA link to this partner at runtime.

Besides that, you may activate the option Accept undefined partners, which results in the NetBIOS/SNA Gateway to positively respond to incoming attachments from other gateways. You may use this function to allow for the connection between two gateways upon request from one side only.



Information Detail Panel

Figure 113. Partner Definitions for IPX or NetBIOS over SNA - Partner

As shown in Figure 113, you have to specify the following:

- **Partner's fully qualified LU name:** This is the partner's CP name in most cases.
- **Partner's alias name:** You can specify an alias as a kind of nickname for the fully qualified LU name. This alias may be used when starting/stopping connections to partner NetBIOS/SNA Gateways (see Figure 123 on page 162).
- **Start link type:** Here you can specify whether you want the link to the partner gateway to be activated by the 2217 at startup time, or if you want to activate it manually, that is, through the RCU only. AutoLink is the default, and you will keep it in most cases.
- **Link mode:** This parameter needs a more detailed discussion. Here you specify the SNA APPC mode that is going to be used for the APPC sessions between partner gateways. When configuring this, there are several things to keep in mind:

  1. This mode needs to be the same on both partner gateways, but a NetBIOS/SNA Gateway may use different modes on different links (to different partners).
  2. The default mode employed here is #BATCH, which uses the COS #BATCH, and thus has a low SNA transmission priority.
  3. When using a relatively slow link (that is, WAN line speeds with a data rate of less than or equal to 128 kbps), try using a mode that uses SNA data compression (for example, #BATCHCS or #INTERCS), because that will give you a significant performance increase in many cases.
  4. When you connect a 2217 NetBIOS/SNA Gateway to a machine running the IBM LTLW program, make sure that both configurations use the same mode (LTLW uses LTLWMODE by default).

6.3.2.3 NetBIOS Name Qualifiers

Name qualifiers provide the NetBIOS/SNA Gateway with a means of filtering frames that are supposed to be transported over the WAN. The concept behind this is that only frames that match a name qualifier will be transported; all other frames will be ignored. Therefore, you have to be careful when it comes to determining the right qualifiers.

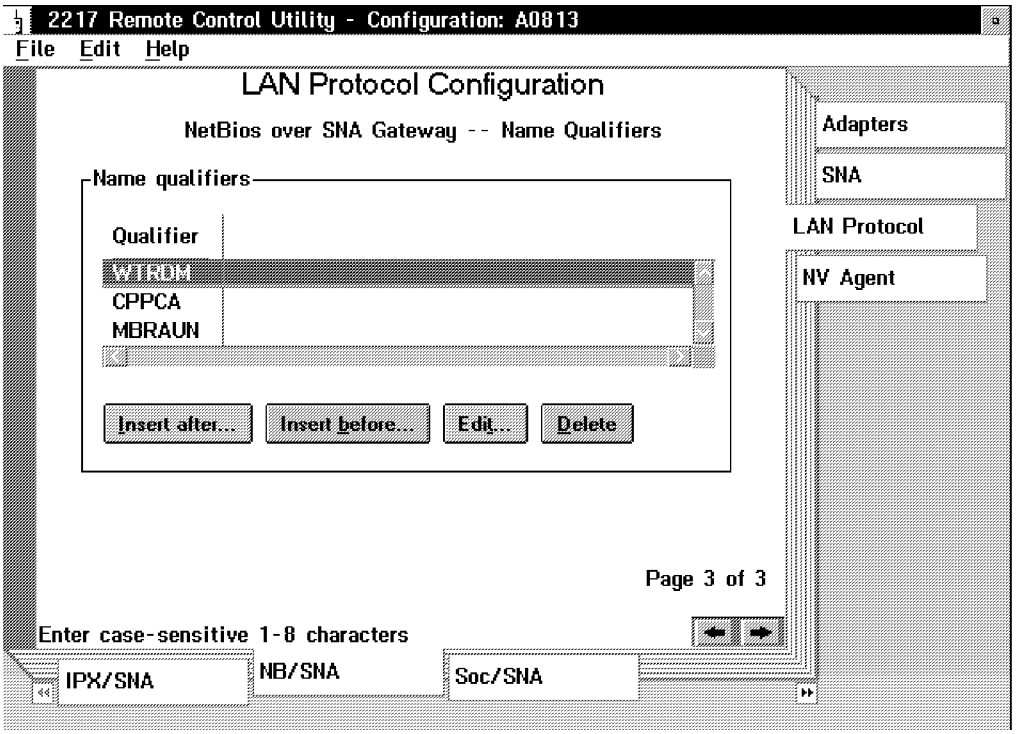


Figure 114. NetBIOS over SNA Gateway - Name Qualifiers

The qualifiers that you configure should match the stations on your local LAN that are supposed to use the NetBIOS/SNA Gateway. When partner NetBIOS/SNA Gateways in different 2217s connect to each other, they exchange information about NetBIOS resources on their local LAN that match the name qualifier patterns. Due to this, you do not configure stations on the remote LAN. Your local 2217 learns about resources in remote LANs through other 2217s.

Avoid using the same name qualifier on more than one 2217. This could lead to the mis-routing of frames. Also avoid making the qualifiers too generic, that is, have too many workstations matching one particular qualifier.

6.3.3 Applying the Configuration to the 2217

When the configuration (as described above) is complete, click on **File**, then **Save and close**. You will be prompted for the configuration file name, and when you have selected an existing file name or entered a new one, two files (configname.RC1 and configname.RC3) are written to the directory where you installed the RCU. The RCU will confirm this action by issuing a pop-up message that says: The configuration files were succesfully saved. Click on **Ok**, and you are returned to the main RCU panel.

In the next step, you will apply this configuration to the 2217. Make sure that your RCU workstation has an active link to the 2217 (check the Communications

Manager Subsystem Management for Logical links, or issue CMLINKS from an OS/2 command line on your RCU workstation).

Next, click on **Execute** next to Apply Configuration to Remote 2217 MpC. You will be prompted to enter the fully qualified network name of the 2217 (for example, USIBMSC.A2217) and the name of the configuration that you want to transfer to the 2217. If you click on the **Select** button, the RCU will display all available configurations in the RCU subdirectory.

Once you select a configuration, click on **Ok**, and the RCU will transfer the configuration files to the 2217, verify and apply them and return with either a display of the log file or a simple message. While the configuration is being applied, the RCU main panel will display a blinking pink Working... If Working... is displayed for several seconds, but not blinking, you might experience a problem with the RCU. In this case, close the RCU and restart it again. You should now be able to apply a configuration without problems.

If your configuration has verified OK on the 2217, you will be prompted with a pop-up message that says: Configuration complete. Reboot 2217? In most cases, you will confirm this by clicking on **Ok**, and the 2217 will reboot. Note that your link to the 2217 is discarded during the reboot, and you might see a message on your RCU workstation (Communications error), indicating that the communication was ended.

If your configuration could not be verified and applied properly, you will be displayed a log file (RMTPUT.LOG), which includes the return codes of several subtasks. Unfortunately, these return codes do not provide a straight-forward approach to the resolution of your configuration problem.

For further information on problem determination, see 6.5, “Problem Determination” on page 164.

6.4 Monitoring and Control of the NetBIOS/SNA Gateway

In this section, we describe the basic options that you have to control the NetBIOS/SNA Gateway. This information is supposed to be considered an addition to Chapter 20, "Using the 2217 RCU to Monitor and Troubleshoot the NetBIOS over SNA Function," of the *IBM 2217 Nways MpC User's Guide, Release 2*.

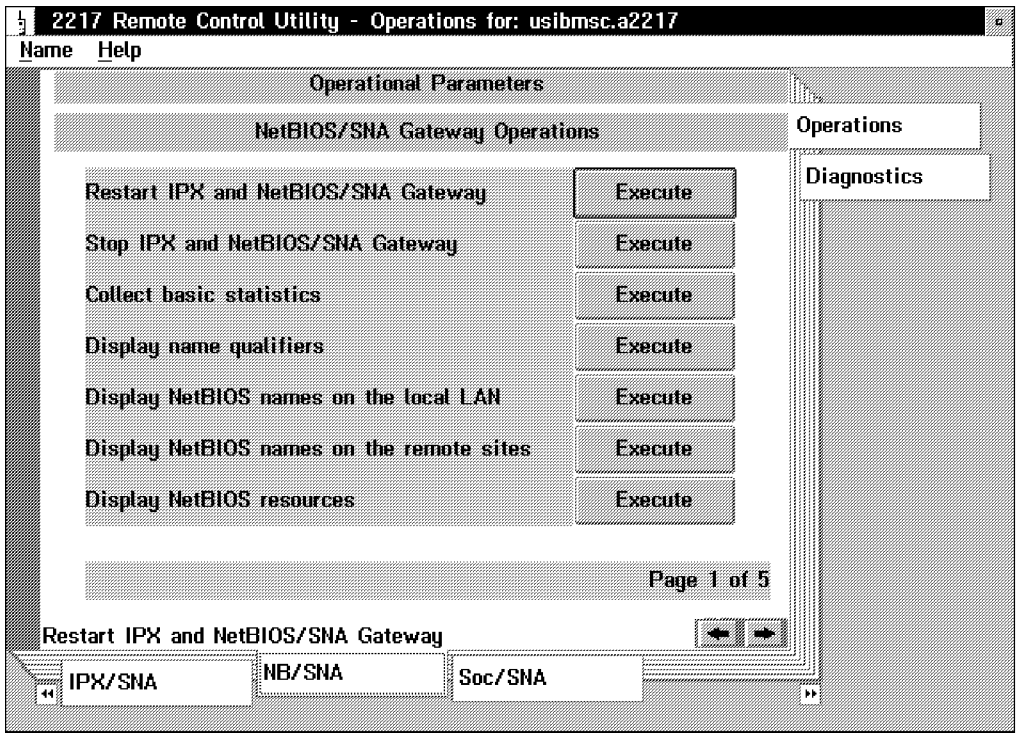


Figure 115. Operational Parameters - NetBIOS/SNA Gateway Operations

As shown in Figure 115, the RCU offers various options to control the actual behavior of the NetBIOS/SNA Gateway. There are even more options available (see the following figures and related explanations).

When you click on **Execute** next to one of the option titles, the RCU obtains the related information from the 2217 and displays the result in a special window which will then be opened. Note that the information displayed may also be saved in a file (for later review), but is not saved by default if you just close the display window.

From this RCU panel (Page 1 of 5), you can initiate the following actions:

- **Restart IPX and NetBIOS/SNA Gateway:** This function allows you to restart only the gateway function (for example, after a LAN failure) without touching any underlying SNA connection. The gateway's links to partner gateways are supposed to be reestablished immediately afterwards (if they were configured as AUTOLINK). Note that this function is performed without further confirmation requested. The output of this function is a mere Command completed, displayed in a separate window.
- **Stop IPX and NetBIOS/SNA Gateway:** This allows you to stop the gateway function isolated from other tasks in the 2217 (and it also shows you its real name, AnyNet LAN Gateway). Figure 116 on page 158 gives an example of the output of this command.

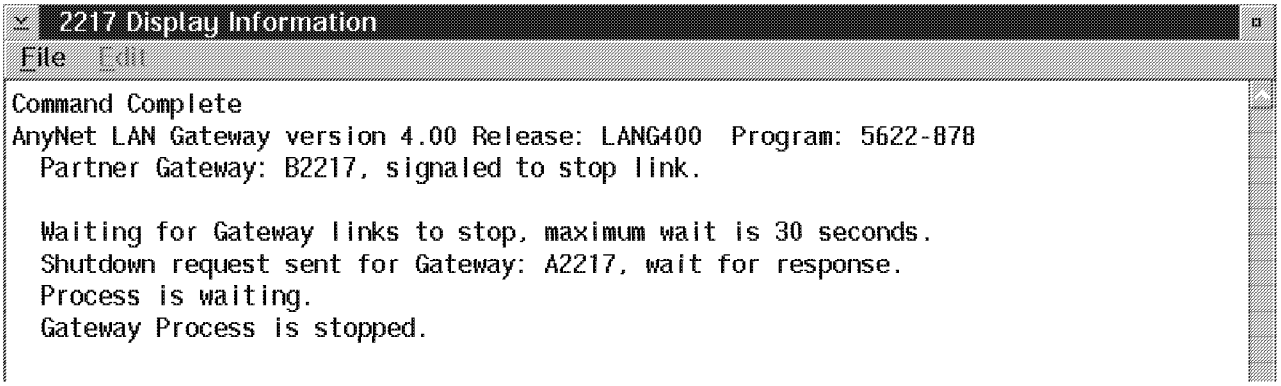


Figure 116. Stop IPX and NetBIOS/SNA Gateway - Command Output Display

- **Collect basic statistics:** This command returns a variety of information and gives you a first impression of your gateway's performance. Figure 117 gives an example of the output of this option.

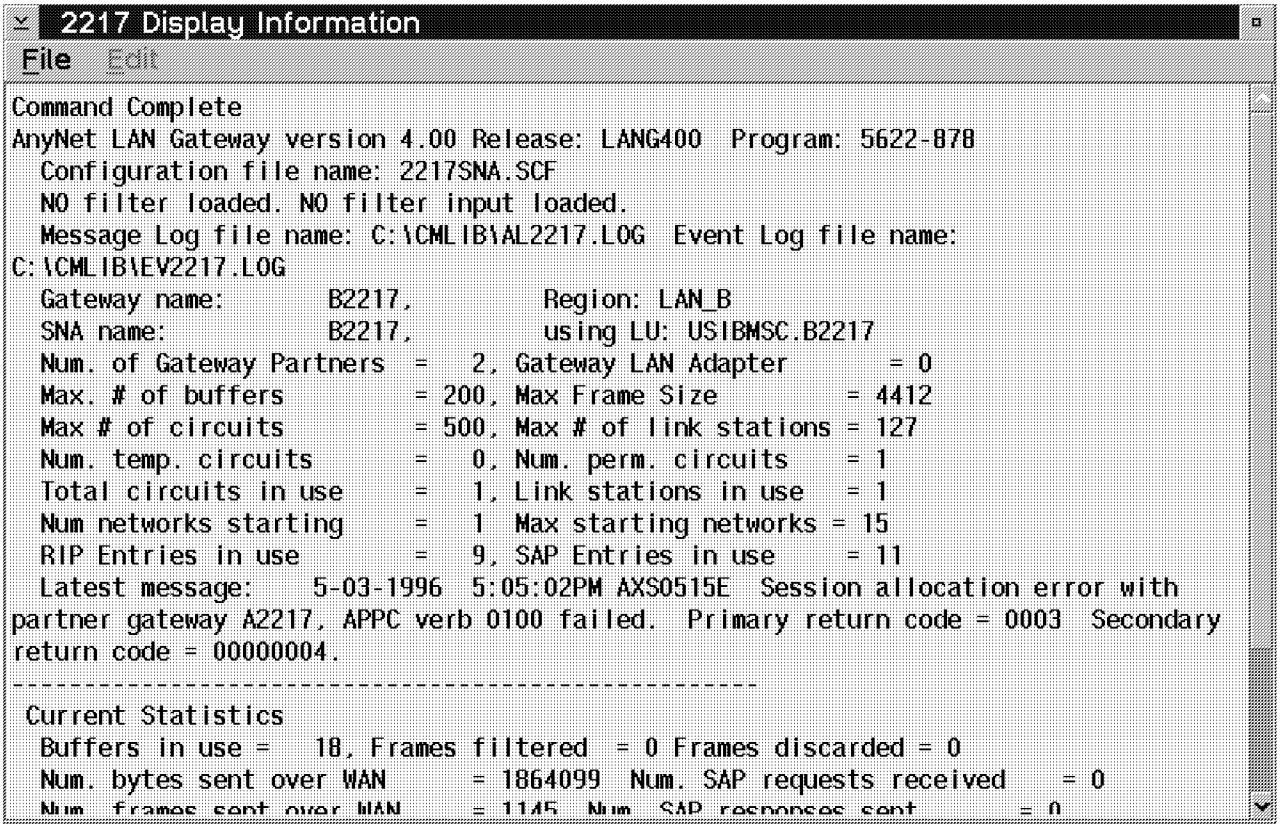


Figure 117. Collect Basic Statistics - Command Output Display

- **Display name qualifiers:** This option returns all the name qualifiers that are currently known to the gateway that you are connected to. The display indicates whether the name qualifiers were configured for this gateway or learned through the connection to partner gateways. Figure 118 gives an example.

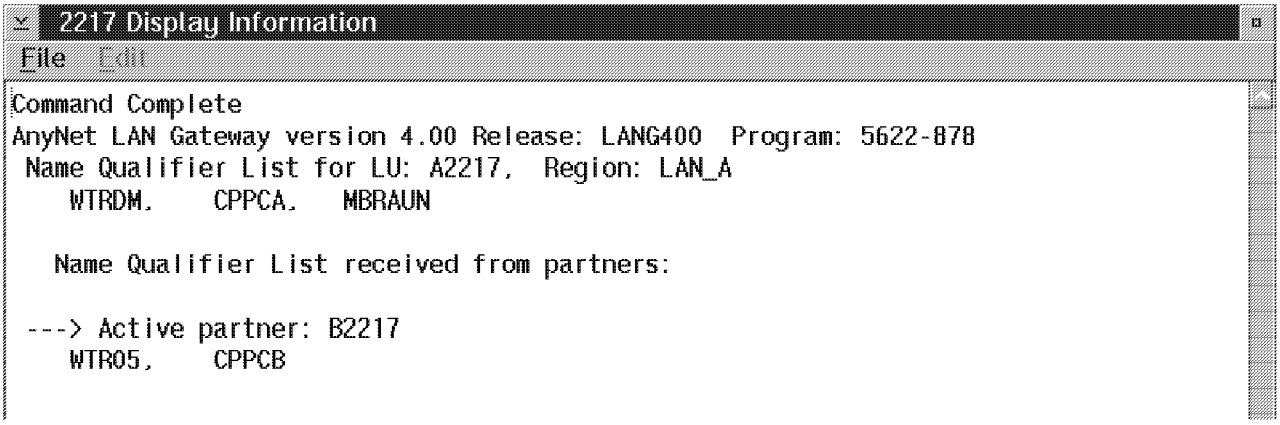


Figure 118. Display Name Qualifiers - Command Output Display

- **Display NetBIOS names on the local LAN:** This allows you to get a list of all NetBIOS names that circle on your local LAN. In case of a particular connection that cannot be established, you might want to check for the existence of the NetBIOS name that you wanted to be used. Note that this list cannot be filtered for your display. Figure 119 gives an example.

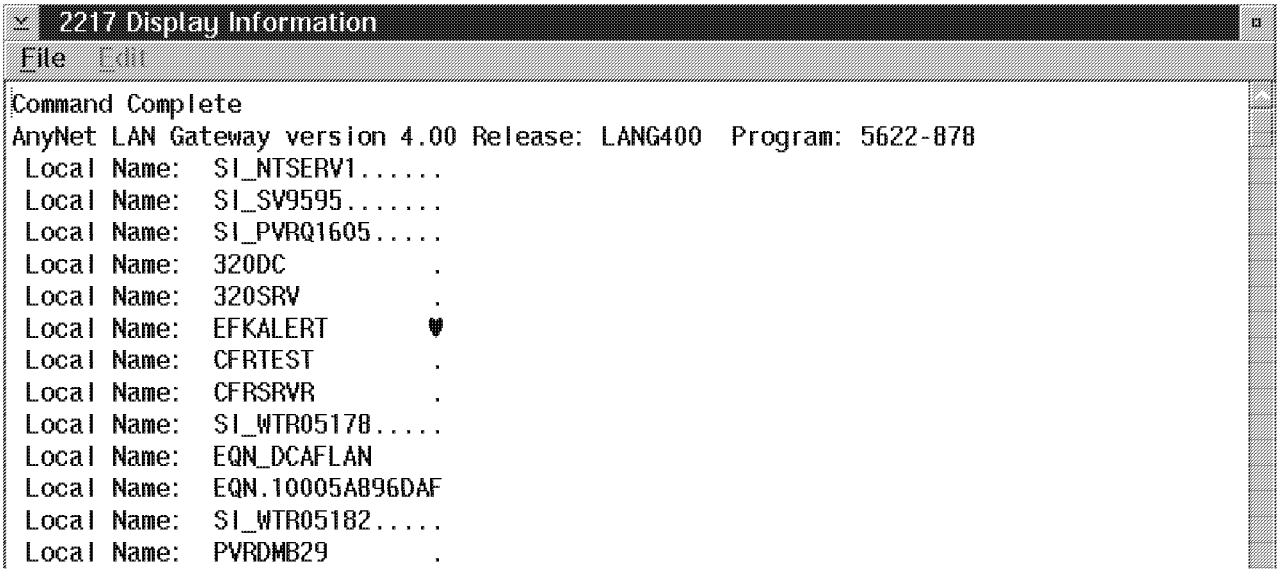
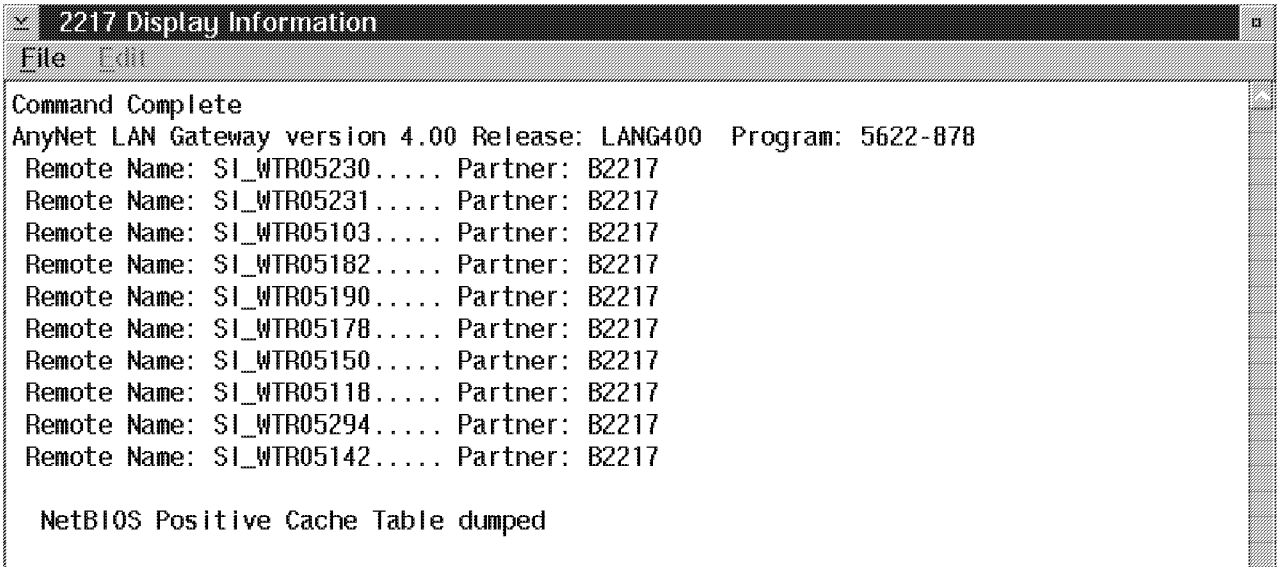


Figure 119. Display NetBIOS Names on the Local LAN - Command Output Display

- **Display NetBIOS names on the remote sites:** This allows you to do the equivalent for the LANs to which you are connected through partner gateways. Figure 120 gives an example.



Output Display

Figure 120. Display NetBIOS names on the Remote Sites - Command

- **Display NetBIOS resources:** This option allows you to monitor specifically the NetBIOS resources as allocated and used by the gateway. It shows you the current status of buffers, circuits, etc. Figure 121 gives an example.

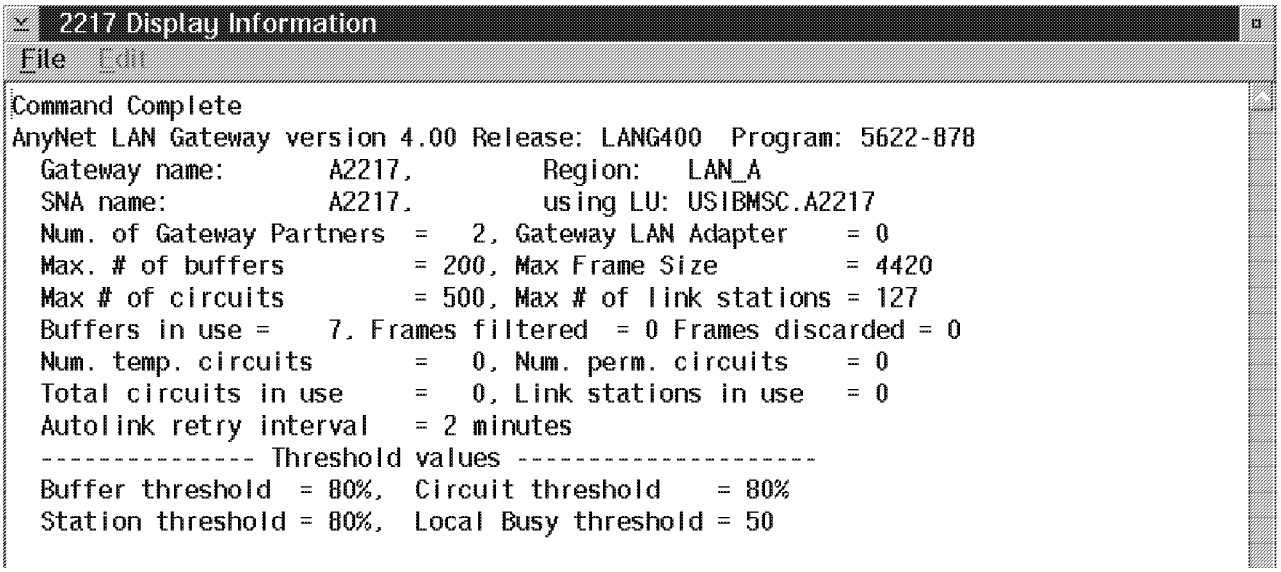


Figure 121. Display NetBIOS Resources - Command Output Display

6.4.1 Operational Parameters

You may want to use this panel to display specific partner statistics. Statistics provided include: Partner name and region, link status, name qualifiers, and buffer utilization.

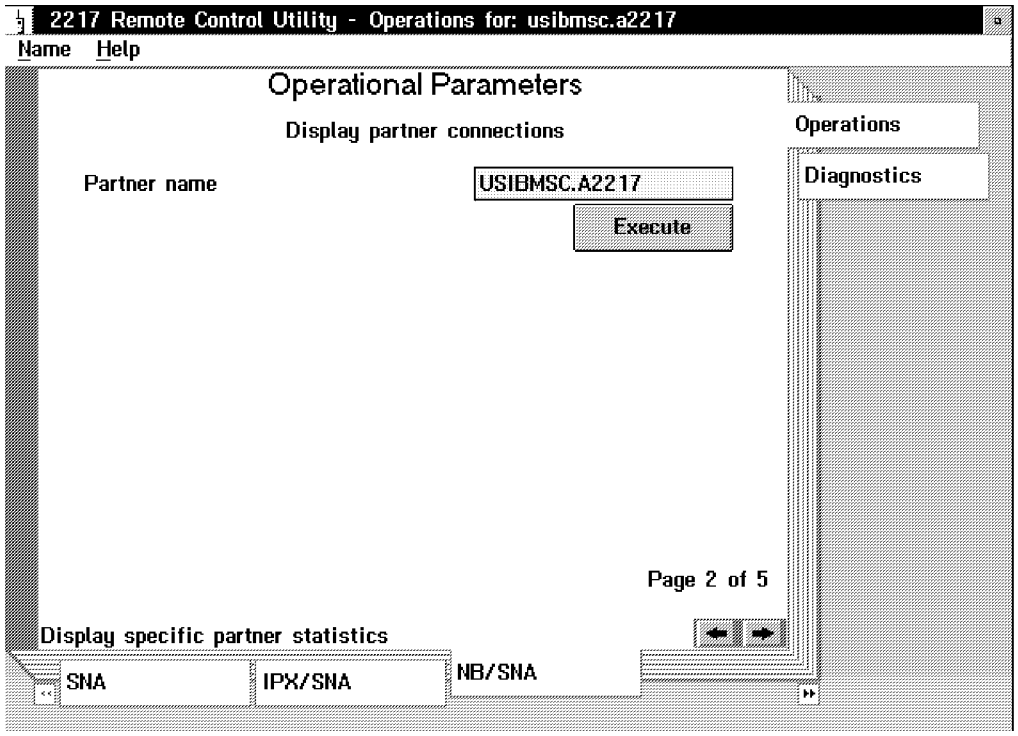


Figure 122. Operational Parameters - Display Partner Connections

On page 2 of the RCU Operational Parameters section for NetBIOS over SNA, you may obtain information from a partner gateway. Enter either the fully qualified network name or just the alias of a partner gateway and click on **Execute** (see Figure 122).

The RCU will display a panel that has information on the status of the gateway (which needs to be active to be able to respond to this request, of course), including the number of bytes transmitted as well as received, the number of frames queued, circuits in use, and the name qualifiers which are currently active for this gateway. This last mentioned piece of information may be especially helpful when working on problem determination.

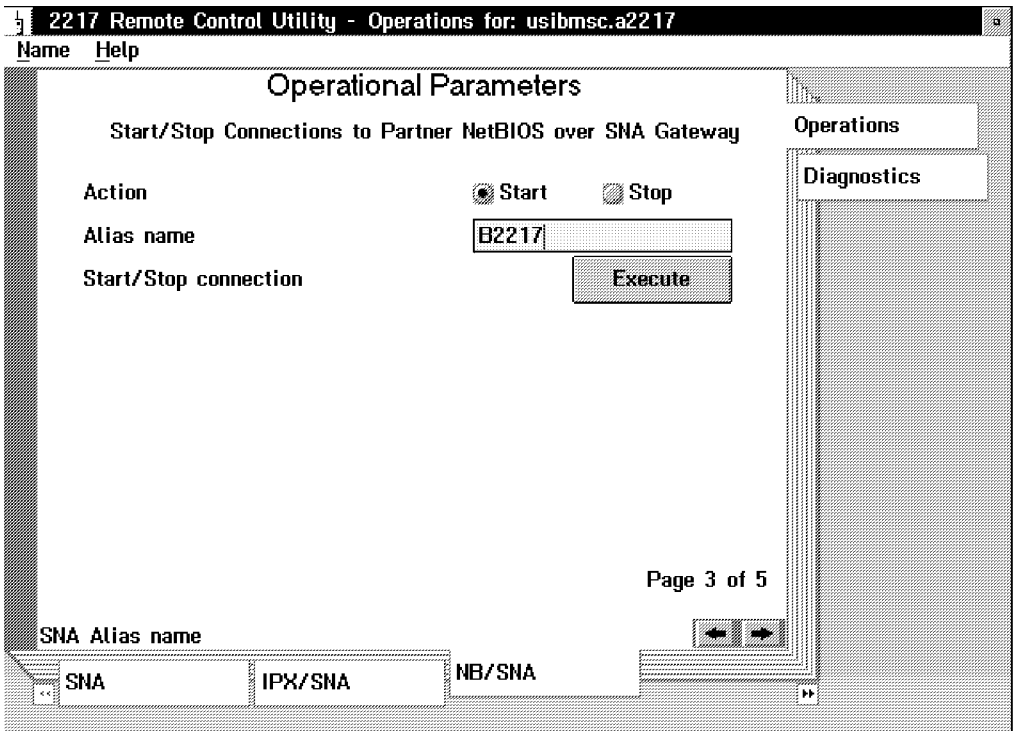


Figure 123. Operational Parameters - Start/Stop Connections to Partner NB/SNA Gateways

The Start/Stop option on page 3 (see Figure 123) allows you to deal with one particular connection to a partner gateway. This option proves helpful when you want to allow for the connection of two given LANs through manual intervention only.

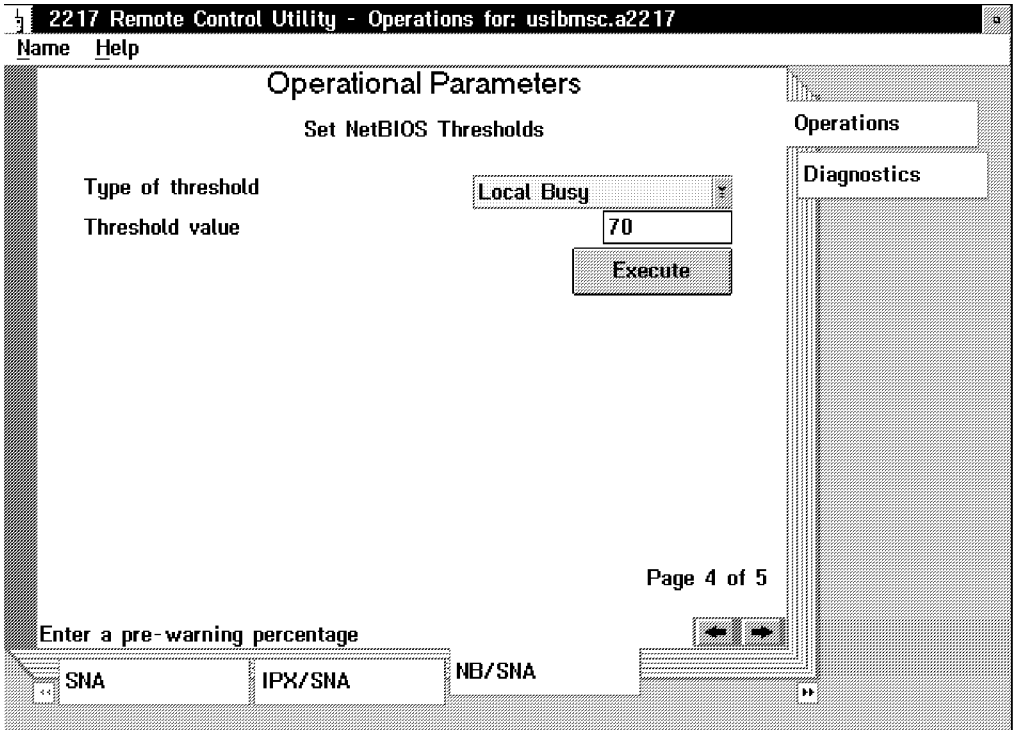


Figure 124. Operational Parameters - Set NetBIOS Thresholds

The option on page 4 (see Figure 124) allows you to dynamically modify the different threshold values that the NetBIOS/SNA gateway monitors internally (see 6.3.2.1, “Parameters That Affect Memory Usage” on page 152).

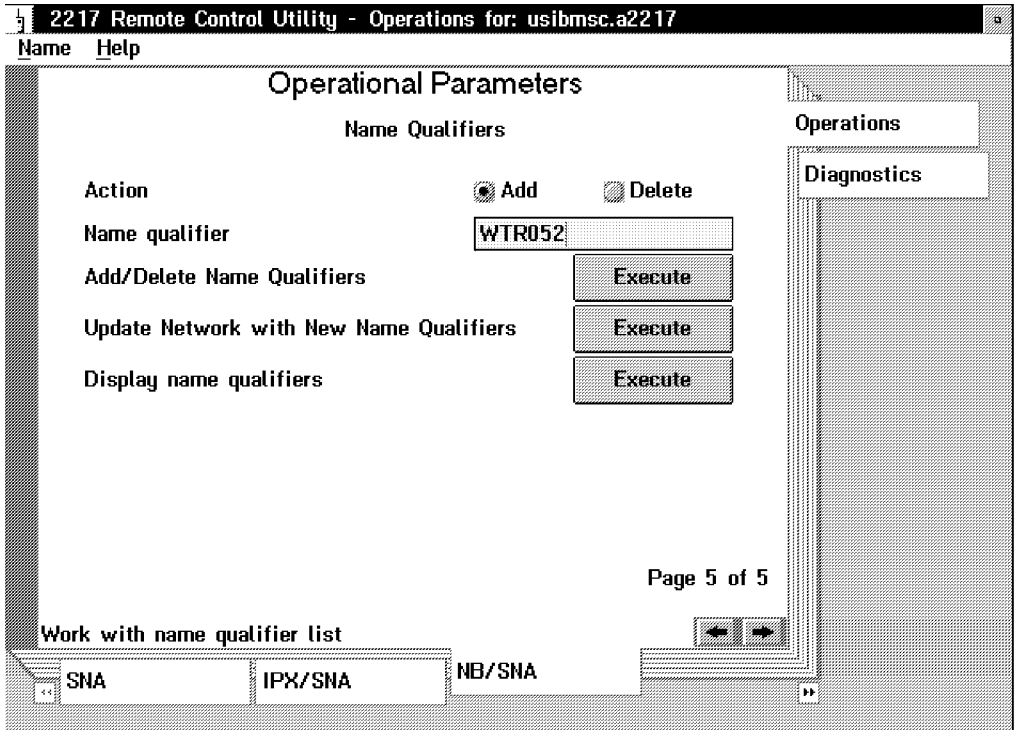


Figure 125. Operational Parameters - Name Qualifiers

The option on page 5 allows you to work with name qualifiers while your gateway is up and running. As shown in Figure 125, you may add or delete name qualifiers. When you have done this, you may use the Update Network with New Name Qualifiers function to have the 2217 send its updated qualifier list to all partner NetBIOS/SNA Gateways. For your convenience, you may display the name qualifier list here as well (without having to go back to page 1 in the Operational Parameters section). Note that the list, if displayed as the result of this function, is always the current list which is used in the 2217 at that time.

6.5 Problem Determination

Sometimes your 2217 will not work like you expect it to, especially when you have applied changes to a working configuration or applied a totally new one. In many cases, this is a result of mistakes during configuration. To analyze the current configuration of a 2217 and to detect the source of the problem, there are a couple of options you might want to try.

Note

Your first option should always be to review your configuration. This can be done through the RCU panels, and also by looking at the configname.RC1 and configname.RC3 files, which contain the source information for all tasks the 2217 is configured for.

Being interested in the NetBIOS/SNA Gateway function primarily, you will especially review the LANGW section in the configname.RC1 file. Here again you will find information on the partner gateways and, for example, the APPC mode used for the connection to a particular partner gateway.

We recommend not to edit the RCx files, because this may lead to unexpected results, using these files with the RCU afterwards. Do not use the RCx files other than to browse the information contained therein.

Before you attempt to run the Operations and Administration of Remote 2217 MpC option of the RCU (this is your second option, of course), make sure your workstation has an active link to the 2217 you are trying to examine. Then, click on **Execute** to establish an APPC connection with the 2217.

In addition to the operations options, which have been described in the preceding section, you will find more problem determination options in the Diagnostics pages of the RCU. We give you more information on what you can expect from these functions here.

However, looking at the underlying SNA status of the 2217 may be very helpful as well, when working towards the solution of an undefined problem. For more information on the SNA part of the Operations section, please see Chapter 2, “SNA Enhancements” on page 19.

The Diagnostics section in the RCU consists of the Log Files part (one page), the Config Files part (two pages) and the Tracing part (seven pages). We have a closer look at the Log Files and Config Files part and the NetBIOS page in the Traces section.

6.5.1 Viewing 2217 Log Files

On the View Log Files page (see Figure 126 on page 165), the RCU provides several functions to obtain helpful information for problem diagnosis.

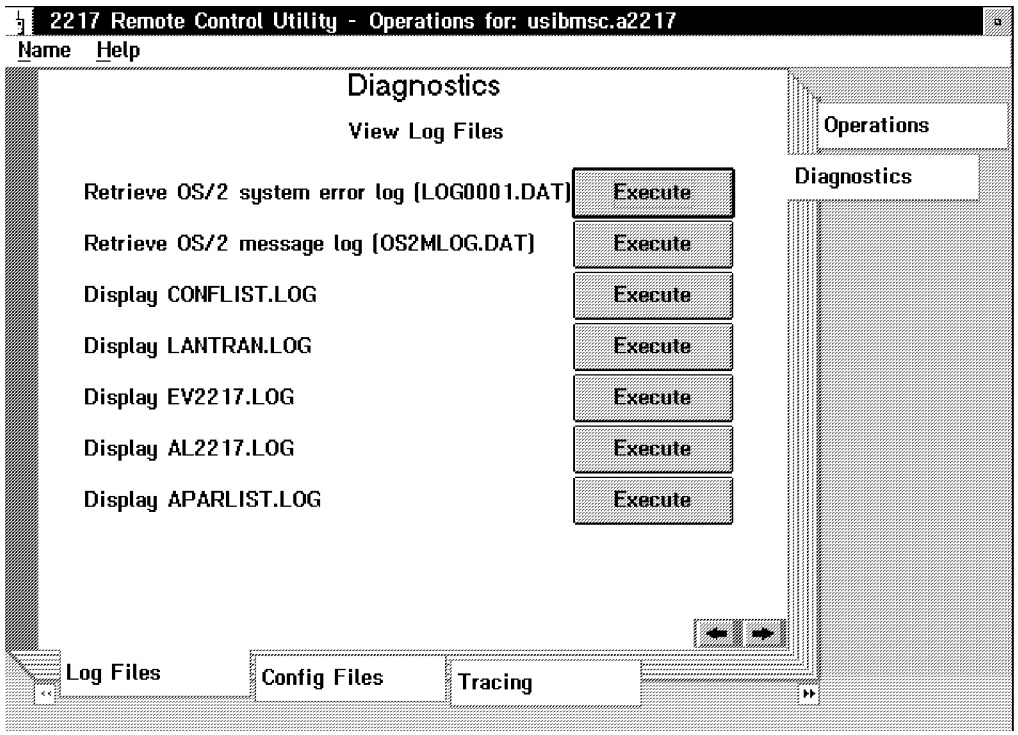


Figure 126. Diagnostics - View Log Files

These functions are:

- **Retrieve OS/2 system error log:** This file is copied from the 2217 to the RCU workstation. It will be copied to the 2217 RCU subdirectory by default. Use the OS/2 System Error Log (in the FFST/2 folder, or issue SYSLOGPM from an OS/2 command line) to open and review this file.
- **Retrieve OS/2 message log:** This file is also copied from the 2217 to the RCU workstation, when you click on **Execute**. Use the OS/2 Message Log Formatter (in the FFST/2 folder, or issue MSGLOGF from an OS/2 command prompt) to open and review this file. Keep in mind that it is stored in the RCU subdirectory.
- **Display CONFLIST.LOG:** As the CONFLIST.LOG is created only when the ARCHIVE function or the Maintenance Distribution Manager (MDM) have been used with this 2217, you may see a message saying that this file could not be found (which may be OK then). When you have used the MDM to perform 2217 maintenance tasks, this file will contain a log entry for every action. (See Chapter 35, "Troubleshooting 2217 Problems," of the *IBM 2217 Nways MpC User's Guide, Release 2* for more information.)
- **Display LANTRAN.LOG:** Displays the 2217's LANTRAN.LOG. May be used to check adapter addresses used in token-ring and frame relay configurations as well as the actual ring speed used.
- **Display EV2217.LOG:** Is supposed to contain events created by the NetBIOS/SNA Gateway function.
- **Display AL2217.LOG:** Is supposed to contain alerts created by the NetBIOS/SNA Gateway function (for example, when thresholds are reached).
- **Display APARLIST.LOG:** This basically returns the output of the OS/2 syslevel command, when issued on the 2217. Included at the bottom of the display are 2217 APARs which have been applied to the machine so far.

6.5.2 Viewing 2217 Configuration Files

On this page (see Figure 127) there are four options to view basic configuration files.

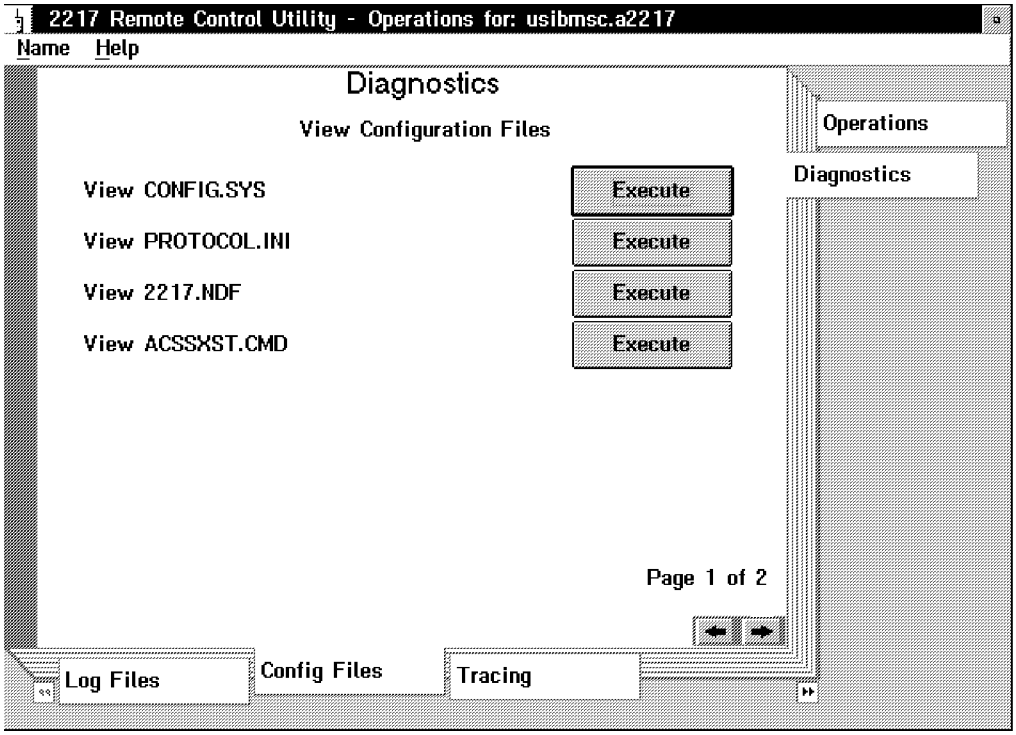


Figure 127. Diagnostics - View Configuration Files (1 of 2)

These are:

- **View CONFIG.SYS:** This displays the 2217's OS/2 CONFIG.SYS.
- **View PROTOCOL.INI:** This displays the 2217's PROTOCOL.INI.
- **View 2217.NDF:** This displays the 2217's Network Definition File (which contains most of the SNA-related configuration information).
- **View ACSSXST.CMD:** The ACSSXST.CMD is dynamically built every time the 2217 is started. It is used when the Sockets over SNA function is started. You may display this file to check whether routes and LUs have been added properly.

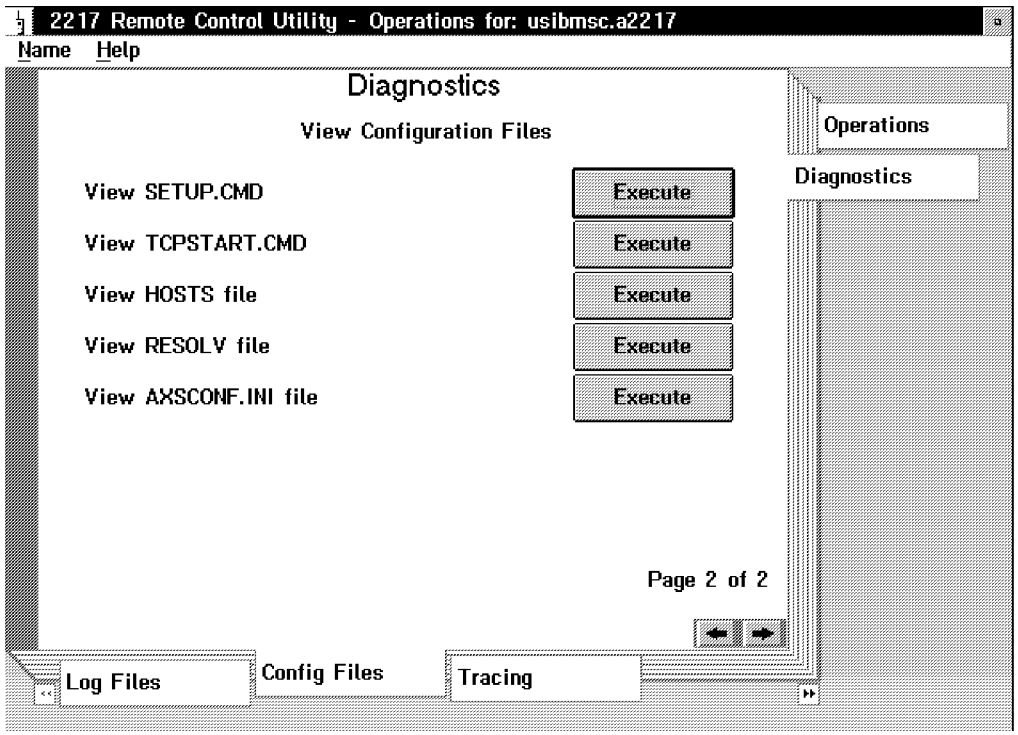


Figure 128. Diagnostics - View Configuration Files (2 of 2)

The configuration information display options are continued on page 2 (see Figure 128).

- **View SETUP.CMD:** This file contains TCP/IP-related configuration information.
- **View TCPSTART.CMD:** This file contains information for the start of the TCP/IP program at OS/2 boot time.
- **View hosts file:** This file contains information on other TCP/IP hosts the 2217 is able to reach.
- **View RESOLV file:** This file usually contains information about the domain name server(s), that the Sockets over SNA and SNA over IP functions may use.
- **View AXSCONF.INI file:** This file contains information which is used by the NetBIOS/SNA and IPX/SNA Gateway function at startup time.

6.5.3 Tracing NetBIOS over SNA Name Qualifiers

As described in the *IBM 2217 Nways MpC User's Guide, Release 2*, when experiencing NetBIOS connectivity problems, you might want to verify that a certain NetBIOS frame really gets across the WAN link. To assist you with this, the RCU provides the NetBIOS trace function. Figure 129 shows how this function gets invoked.

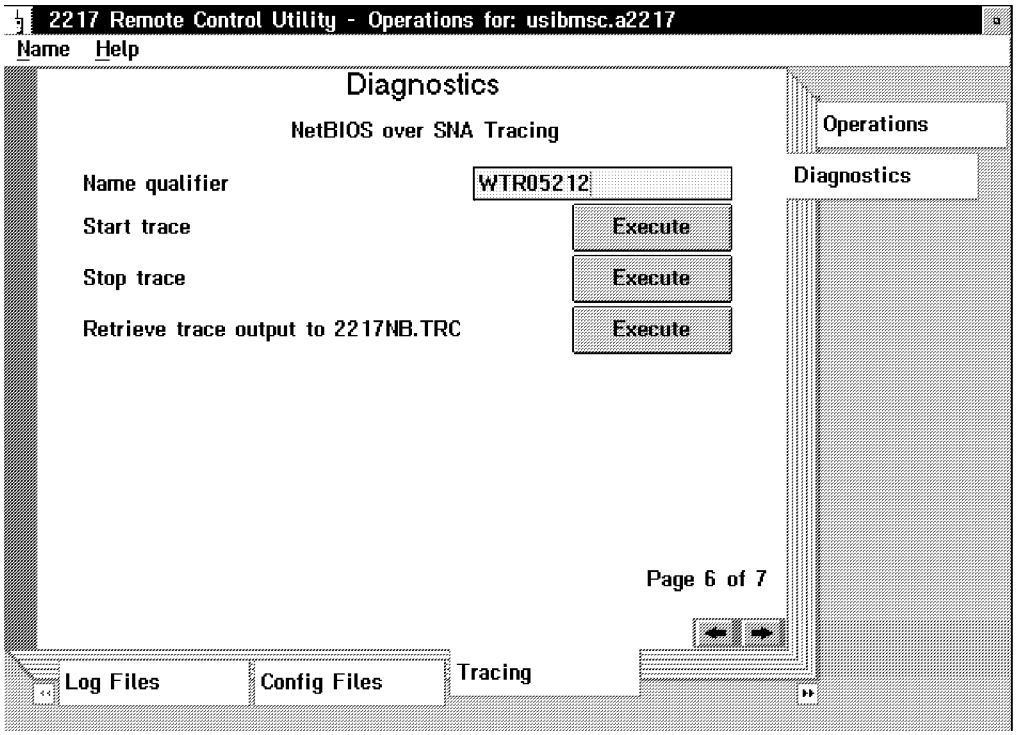


Figure 129. Diagnostics - NetBIOS over SNA Tracing

Chapter 7. IPX Applications Over SNA

This chapter describes how to configure the IBM 2217 MpC to support IPX application traffic over an SNA connection. To use the information in this chapter, you should reference IPX Router Specification for basic information about setting up IPX networks. You should also refer to Chapter 5, "Overview of SNA Support Provided by the 2217" on page 5-1 of the *2217 Nways Multiprotocol User's Guide* for information about the SNA support provided by the 2217.

7.1 How the 2217 Transports IPX Data over SNA Connections?

At the link layer, IPX is a connectionless protocol. IPX relies on applications to advertise their services in order to find addresses. Routers pass the servers' advertisements around the network. These functions use servicing protocol (SAP) and routing information protocol (RIP).

When a requester wants to access a server, it sends out frames asking where the nearest server is and then asks how to access that destination server. Each router on the network, including the 2217s, helps local workstations address the correct server by maintaining and supplying SAP and RIP information from other regions of the network.

The 2217 obtains SAP and RIP information from the local LAN during startup and passes this information to each partner 2217 it connects to over the LAN. As SAP and RIP information is updated, the 2217 resends the information to each partner 2217. Repetitive SAP and RIP broadcasts that do not provide updated information are filtered out and do not pass across the SNA network.

Approximately once every minute, the 2217 scans for network configuration changes. If the configuration has changed during the time interval, such as a server shutting down, the 2217 makes the appropriate changes to its tables and sends the changes to its partner 2217s.

The 2217 uses a single pair of LU-LU sessions to transport IPX traffic across the SNA connection. All IPX traffic uses the same transmission prioritization. If you are also running NetBIOS traffic between the 2217s, the IPX traffic uses the same LU-LU session pair as used by the NetBIOS traffic.

7.2 Scenario Description

In this chapter, we configure the IBM 2217 MpC to provide LAN Gateway support to connect LANs in order to run IPX applications over WAN. The IBM 2217 MpC boxes are point-to-point frame relay connected using the two ports provided by the WAC adapter.

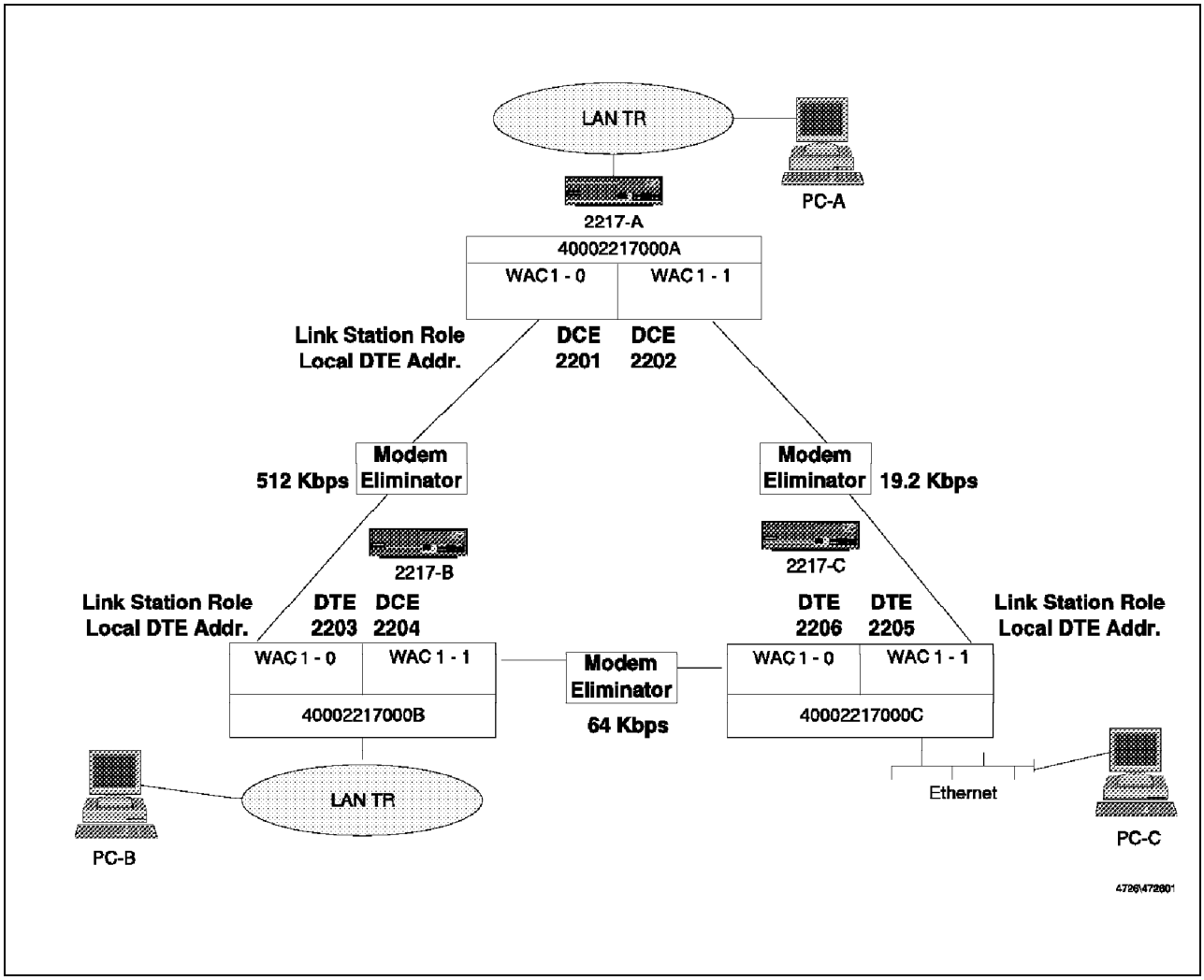


Figure 130. IPX over SNA Configuration Scenario

7.3 Configuration Example

A configuration for the 2217s to allow the transport of IPX frames over an SNA frame relay network has to include at least the following:

- At least one WAC and one token-ring LAN adapter per 2217
- SNA network information (links, DLCs, LUs, etc.)
- LAN protocol information (links to other LANs, filters, etc.)

7.3.1 SNA Network Configuration Example

The information contained in this section is similar to the one contained in Chapter 6, “NetBIOS Applications over SNA” on page 145. Please see this chapter for more details on the topology and configuration of the sample network.

7.3.2 LAN Protocol Configuration Example

Many configuration panels for the LAN environment used in our sample network are the same for NetBIOS and IPX. For this reason, you may want to reference Chapter 6, “NetBIOS Applications over SNA” on page 145. The default values used for NetBIOS will also work for IPX and will give you reasonable performance.

7.3.2.1 Protocol Stacks and Network IDs

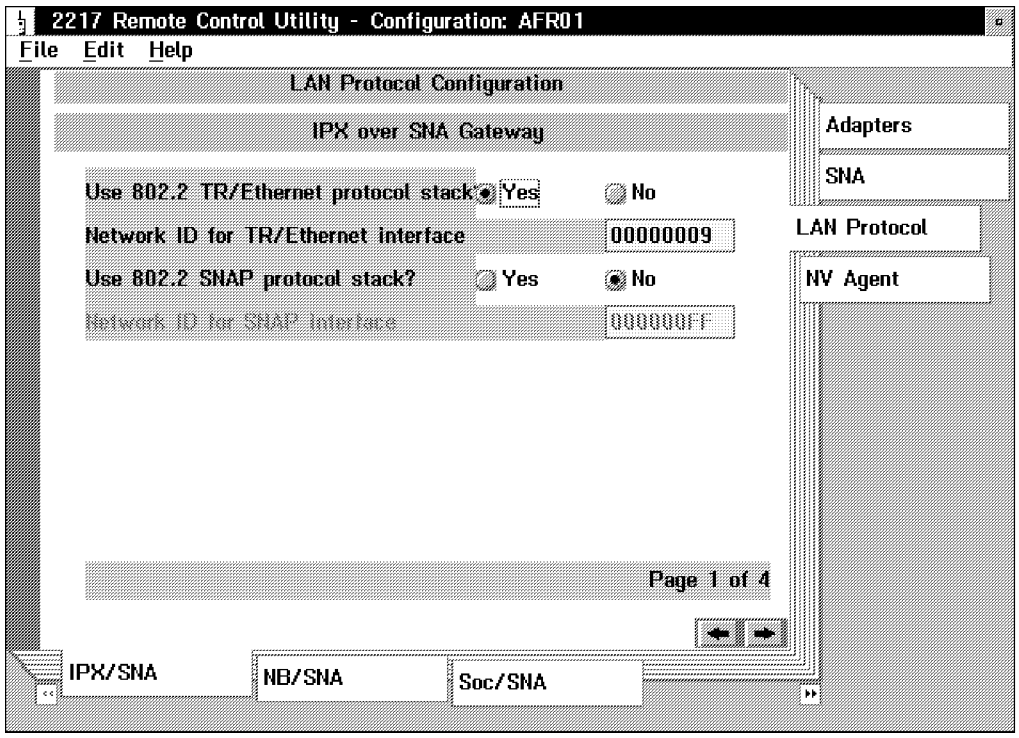


Figure 131. LAN Protocol Configuration - IPX over SNA Gateway (Page 1 of 4)

The following configuration values are used in this panel as shown in Figure 131:

- **Use 802.2 TR/Ethernet protocol stack:** This field specifies whether the 2217 uses the 802.2 service access point (SAP) E0 interface for IPX traffic:
  - Yes if the interface is used.
  - No if the interface is not used (default value).

  Notes:

  1. The 802.2 interface uses SAP E0 on either Ethernet or token-ring.
  2. To use the IPX/SNA Gateway in the 2217, either the value of this field or the Use 802.2 SNAP Protocol field (or both) must be Yes.
  3. If Use 802.2 SNAP Protocol is also Yes, the network IDs must be unique.
- **Network ID for TR/Ethernet interface:** This field specifies the NetWare network ID for the 802.2 (service access point E0) interface to which the 2217 is attached. It is used for the 802.2 type frames on this LAN segment. In our configuration the network ID is 00000009. The default value is 0000000A.

Important

You must configure the exact network ID. Make sure you obtain this information directly from your IPX coordinator in your installation.

Note: The 2217 uses an 8-character hexadecimal value to identify a LAN segment. This value for the 2217 must match the value set in the Novell server when they are attached directly to the same LAN. The 2217 remote to the Novell server LAN must have its own unique value.

- **Use 802.2 SNAP protocol stack:** This field specifies whether the 2217 uses the sub-net access point (SNAP) interface:
  - Yes if the interface is used.
  - No if the interface is not used (default value).

  Notes:

  1. The SNAP protocol uses the service access point AA on either Ethernet or token-ring.
  2. To use the IPX/SNA Gateway in the 2217, the value of this field or the Use 802.2 TR/Ethernet Interface field (or both) must be Yes.
  3. If Use 802.2 SNAP TR/Ethernet Interface Protocol is also Yes, the network IDs must be unique.
- **Network ID for SNAP interface:** This field specifies the NetWare network ID for the subnetwork access point (SNAP), service access point AA, and LAN type to which the 2217 is attached. It is used for the SNAP type frames on this LAN segment. The default value is 000000FF.

7.3.2.2 Buffers and Thresholds

In this panel, you configure the threshold values for the IPX over SNA Gateway function. In most cases, default values work fine for the majority of configuration scenarios.

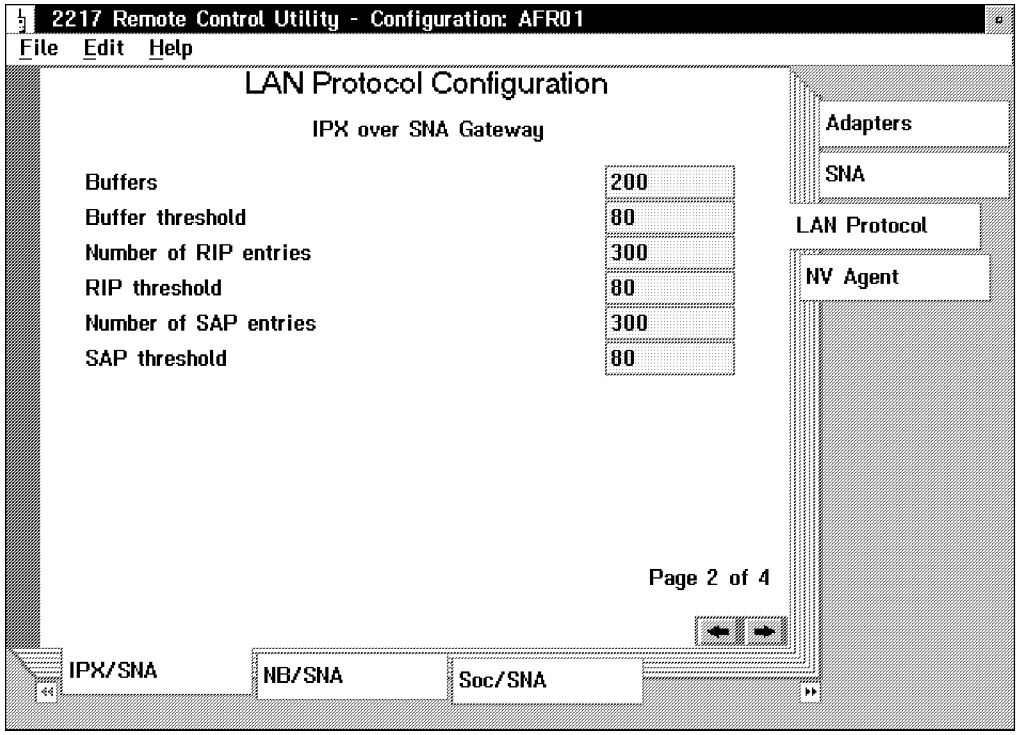


Figure 132. LAN Protocol Configuration - IPX over SNA Gateway (Page 2 of 4)

- **Buffers:** Defaults to 600, may be reduced to 200 or another lower value in most cases. See the *IBM 2217 Nways MpC User's Guide, Release 2* for more information on this parameter.
- **Buffer threshold:** This field specifies the buffer threshold percentage that must be met before a warning is issued indicating that the number of buffers in use is approaching the maximum number of buffers. The default is 80%.

  For example, the threshold percentage value of 65 indicates when the 2217 reaches the threshold when 65 percent or more of that resource is in use. When a resource threshold is reached, a message is logged in AL2217.LOG, SNA alerts are generated, and if an SNMP agent is enabled, SNMP trap messages are sent.

  Higher values for percentage thresholds result in notification closer to the point that the resource is depleted. A lower value results in earlier and possibly more frequent messages, alerts, and traps.
- **Number of RIP entries:** This parameter limits the number of IPX routers, IPX LANs and IPX servers that can communicate over an SNA network. The default value is 300.

  Routing information protocol (RIP) is used in IPX to distribute routing information through a network. Each IPX router maintains a RIP table that contains routing information such as network numbers, hop counts, and a metric for reaching remote networks.

Because the 2217 can support a maximum of 1000 RIP entries, an SNA network is limited to 1000 servers and IPX LANs.

Each server uses one RIP entry to advertise its routes. Each IPX LAN uses one RIP entry.

- **RIP threshold:** This field specifies a percentage used to trigger a warning when the number of route information protocol (RIP) table entries in use approaches the number specified in the number of RIP entries field. The RIP entries are used when forwarding NetWare IPX frames between the local area network and the wide area network. The default value is 80%.

  For example, the threshold percentage value of 65 indicates that the 2217 reaches the threshold when 65 percent or more resources are in use. When a resource threshold is reached, a message is logged in the AL2217.LOG, SNA alerts are generated, and if an SNMP agent is enabled, SNMP trap messages are sent.

  Higher values for percentage thresholds result in notification closer to the point that the resource is depleted. A lower value results in earlier and possibly more frequent messages, alerts, and traps.

- **Number of SAP entries:** SAP stands for service advertising protocol. This parameter limits the number of IPX servers that can use the service advertising protocol (SAP) to identify their services to remote LANs that are attached to an SNA network. One server may advertise multiple services. Each service uses one SAP entry. The default value is 300.

- **SAP threshold:** This field specifies a percentage used to trigger a warning when the number of service advertising protocol (SAP) table entries in use approaches the number specified in the Maximum SAP entries parameter. The SAP entries are used when forwarding NetWare IPX frames between the local area network and the wide area network. The default value is 80%.

  For example, the threshold percentage value of 65 indicates that the 2217 reaches the threshold when 65 percent or more of that resource is in use. When a resource threshold is reached, a message is logged in AL2217.LOG, SNA alerts are generated, and, if an SNMP agent is enabled, SNMP trap messages are sent.

  Higher values for percentage thresholds result in notification closer to the point that the resource is depleted. A lower value results in earlier and possibly more frequent messages, alerts, and traps.

7.3.2.3 Partner Information

This is the same as in the Chapter 6, “NetBIOS Applications over SNA” on page 145. In fact, the same settings show up in the NB/SNA as well as in the IPX/SNA section. If they are configured in either one, they are configured for both.

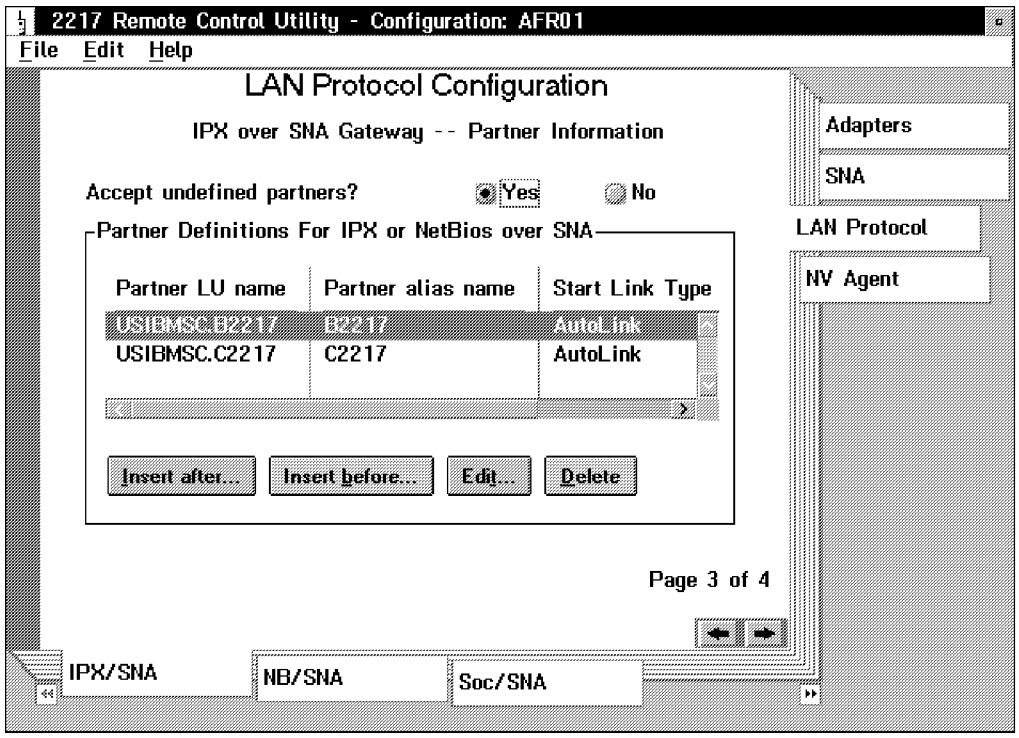


Figure 133. LAN Protocol Configuration - IPX over SNA Gateway (Page 3 of 4)

7.3.2.4 Name Qualifiers

For IPX, name qualifiers are used as access filter lists to manage the number of service advertising protocol (SAP) entries throughout the network. Name qualifiers are used as an option to limit access to specific NetWare servers.

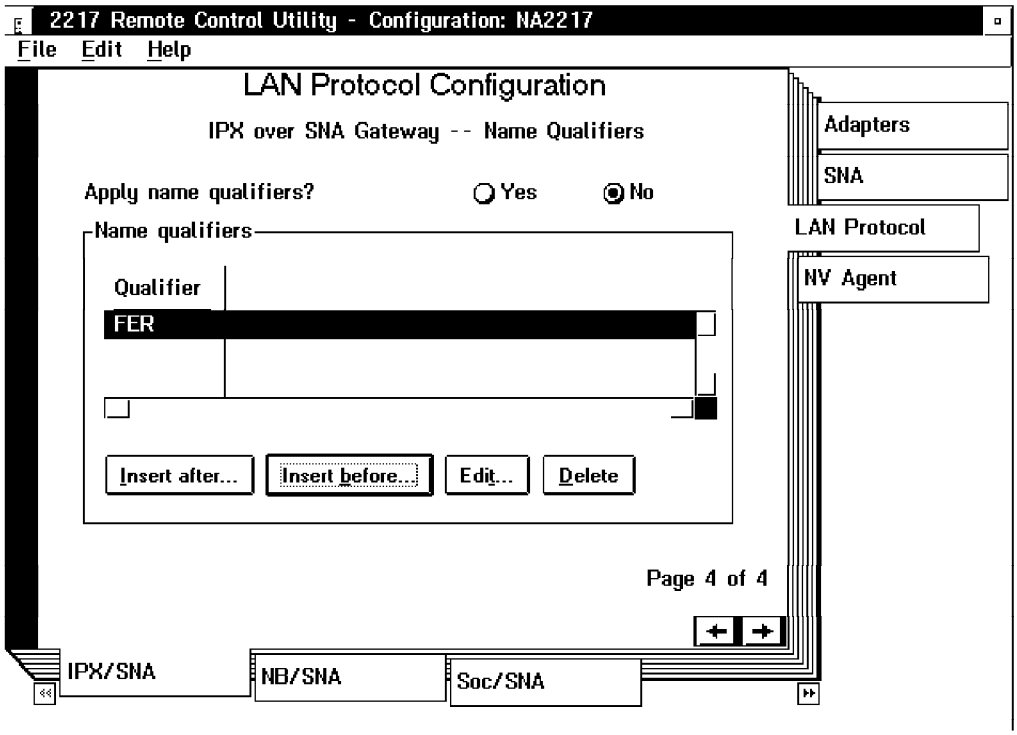


Figure 134. LAN Protocol Configuration - IPX over SNA Gateway (Page 4 of 4)

- **Apply name qualifiers:** This field specifies whether the 2217 uses name qualifiers for IPX traffic:
  - Yes if name qualifiers are used.
  - No if name qualifiers are not used (default value).

Note

The same name qualifiers apply for both NB/SNA and IPX/SNA and need to be configured only once. See the *IBM 2217 Nways MpC User's Guide, Release 2* or Chapter 6, “NetBIOS Applications over SNA” on page 145 for more information.

7.4 Monitoring and Control of the IPX/SNA Gateway

In this section, we show a few options you have to display and monitor IPX/SNA traffic.

7.4.1.1 IPX/SNA Gateway Operations

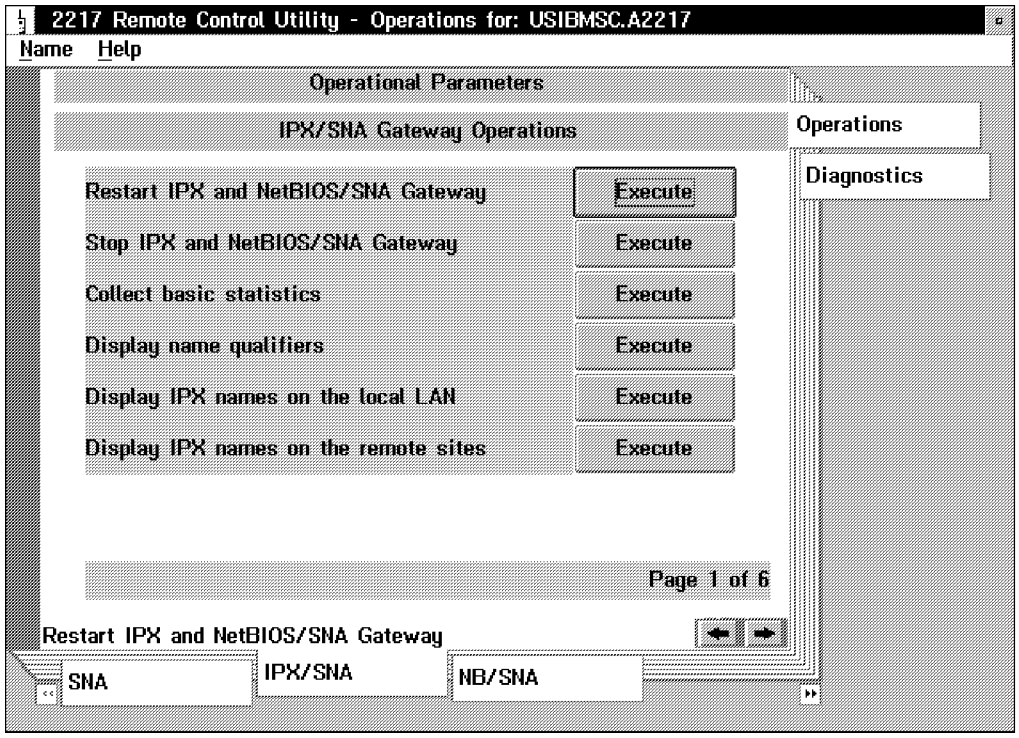


Figure 135. Operational Parameters - IPX/SNA Gateway Operations (Page 1 of 6)

The following options are used in this panel as shown in Figure 135:

- **Restart IPX and NetBIOS/SNA Gateway:** Click on the **Execute** push button to have the IPX/SNA and NetBIOS/SNA function restarted.
- **Stop IPX and NetBIOS/SNA Gateway:** Click on the **Execute** push button to shut down the IPX/SNA and NB/SNA function.
- **Collect basic statistics:** Click on the **Execute** push button to gather basic statistics about gateway operations. A remote 2217 gathers the statistical information for NetBIOS and IPX over SNA and sends it to the Remote Control Utility (RCU) to display.
- **Display name qualifiers:** Click on the **Execute** push button to view the name qualifer list. The qualifier lists determine to which specific region the 2217 should route session startup or datagram frames. The name qualifier list is required for NetBIOS routing and optional for IPX in providing specific access to NetWare servers. You can apply the name qualifier list to NetWare servers if you wish to to manage specific access over the WAN.
- **Display IPX names on the local LAN:** Click on the **Execute** push button to view the local IPX address the 2217 has found on the local LAN. This information is sent to the Remote Control Utility (RCU) for display.

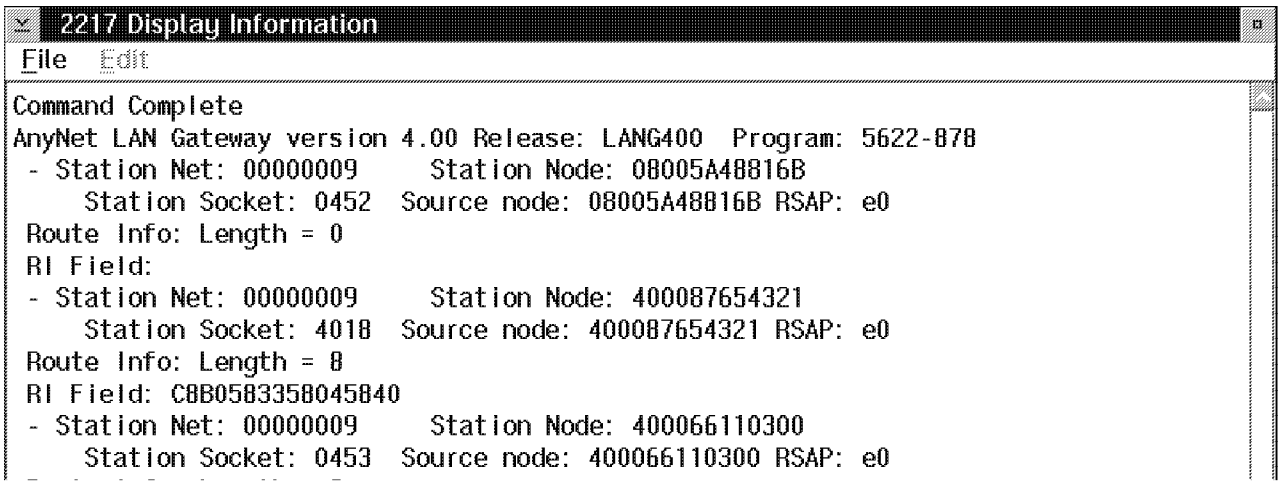


Figure 136. Operational Parameters - Local IPX Names Display

- **Display IPX names on the remote sites:** Click on the **Execute** push button to view remote IPX addresses the 2217 has found. This information is forwarded to the Remote Control Utility (RCU) for display.

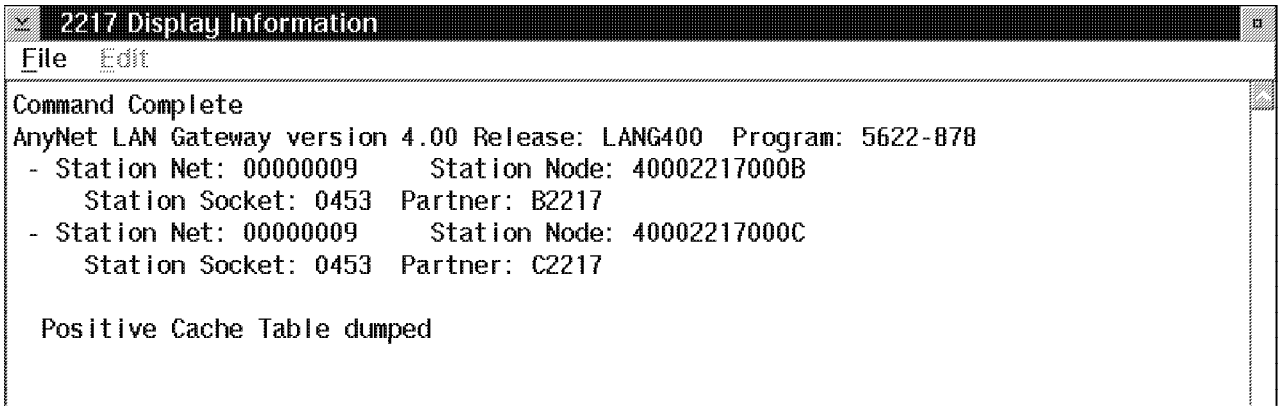


Figure 137. Operational Parameters - Remote IPX Names Display

7.4.1.2 Display SAP and RIP Tables

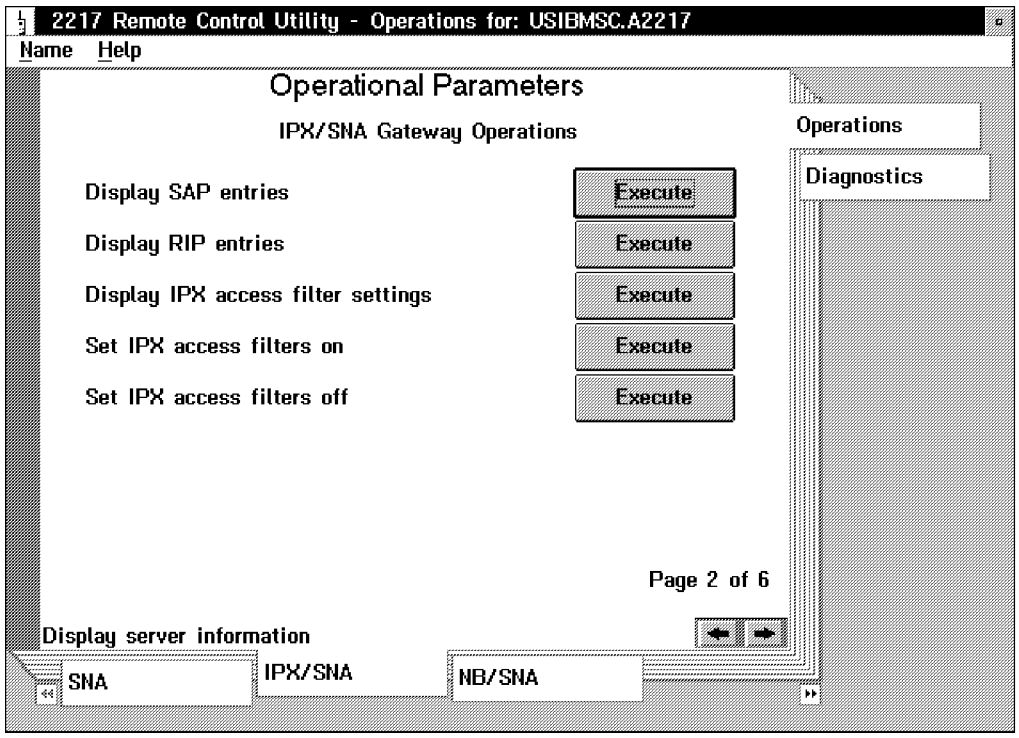


Figure 138. Operational Parameters - IPX/SNA Gateway Operations (Page 2 of 6)

The following options are used in this panel as shown in Figure 138:

- **Display SAP entries:** Click on the **Execute** push button to display the service advertising protocol (SAP) table entries.

  Note: SAP is an IPX protocol by which servers advertise their presence on a network. Each IPX router on the network keeps a table of SAP information containing the server's name, address, hop count and server type.

- **Display RIP entries:** Click on the **Execute** push button to display routing information protocol (RIP) entries.

  Note: Each IPX router keeps a table of RIP information containing network IDs, hop counts, and a metric in reaching the remote networks.

- **Display IPX access filter settings:** Click on the **Execute** push button to display the IPX access filter settings.

- **Set IPX access filters on:** This field sets access filters on. Applying the name qualifiers to NetWare servers is optional. The name qualifier list will act as an access filter if this is on. It is initially recommended that you do not apply the name qualifier list to the IPX servers. This will enable all IPX servers to be advertised and seen on all 2217 links.

  If there are more than 300 services propagated when the 2217 provides remote LAN access, then you should plan to specify the services needed for remote access. Specify the name of the service on the name qualifier list to apply the NetWare servers to the list.

- **Set IPX access filters off:** This field sets access filters off. Applying the name qualifiers to NetWare servers is optional. The name qualifier list will act as an access filter if this is on. It is initially recommended that you do not apply

the name qualifier list to the IPX servers. This will enable all IPX servers to be advertised and seen on all 2217 links.

If there are more than 300 services propagated when the 2217 provides remote LAN access, then you should plan to specify the services needed for remote access. Specify the name of the service on the name qualifier list and select to apply the NetWare servers to the list.

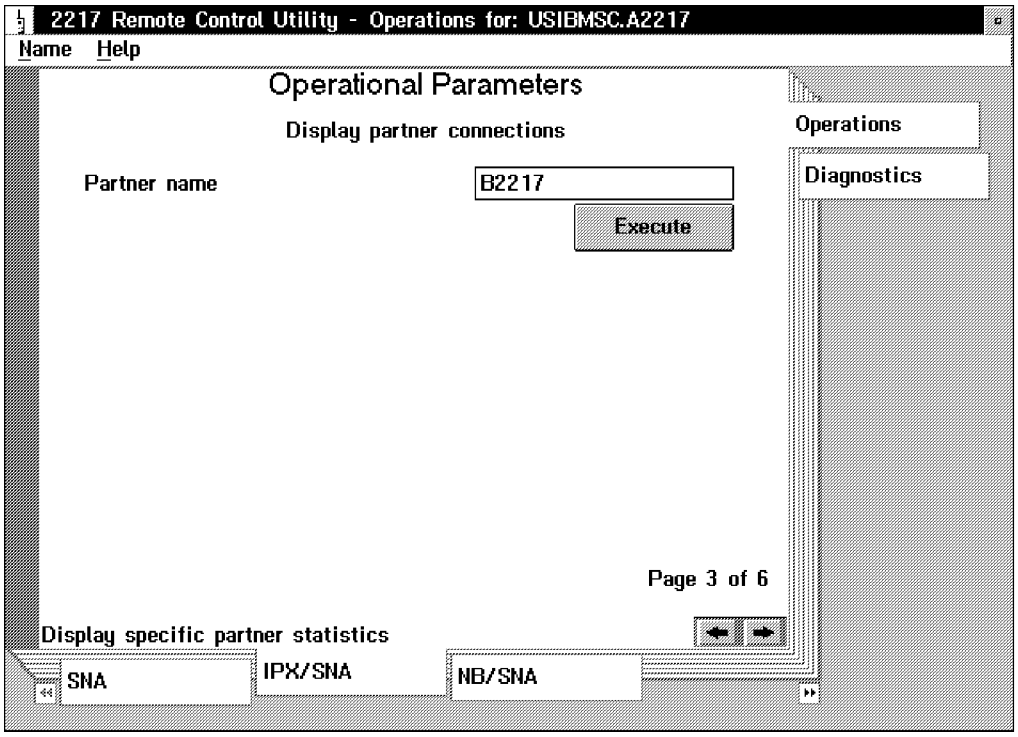


Figure 139. Operational Parameters - IPX/SNA Gateway Operations (Page 3 of 6)

- **Partner name:** It displays specific partner statistics. The SNA alias name is required. Statistics provided include: partner name and region, link status, name qualifiers, and buffer utilization.

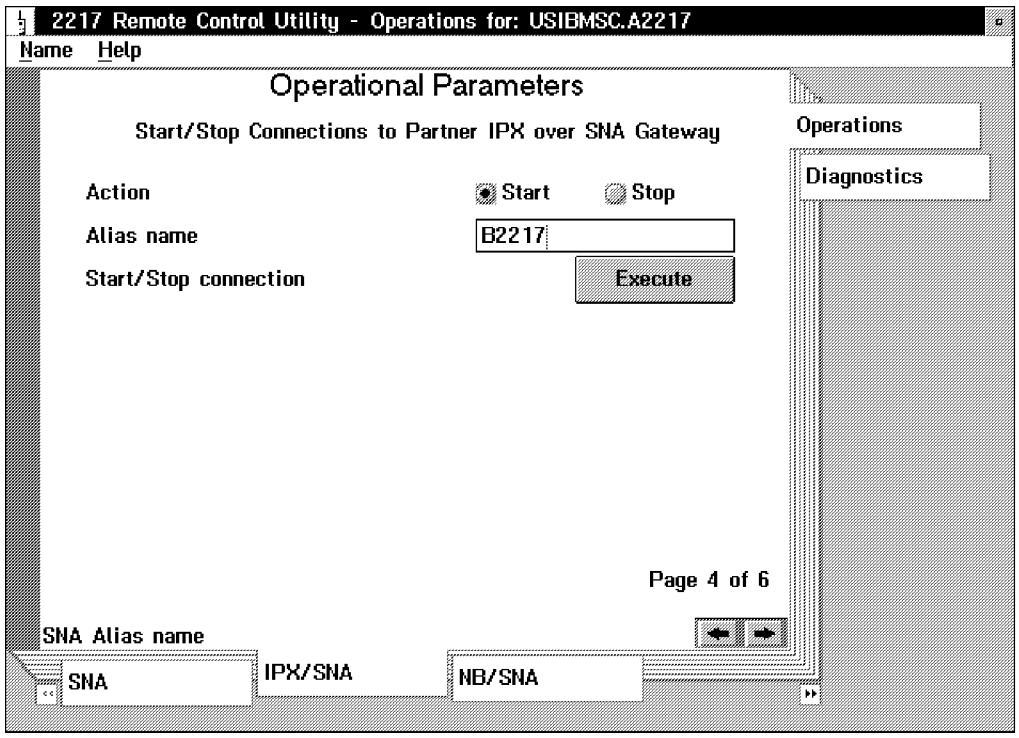


Figure 140. Operational Parameters - IPX/SNA Gateway Operations (Page 4 of 6)

- **Action:** Select a radio button to manage connections to a partner IPX over SNA Gateway:
  - Start to start a connection (default value)
  - Stop to stop a connection
- **Alias name:** The SNA alias name is required. This is the alias of the partner LU (PLU) used for the IPX over SNA Gateway function.
- **Start/Stop connection:** Click on the **Execute** push button to start or stop the specified connection.

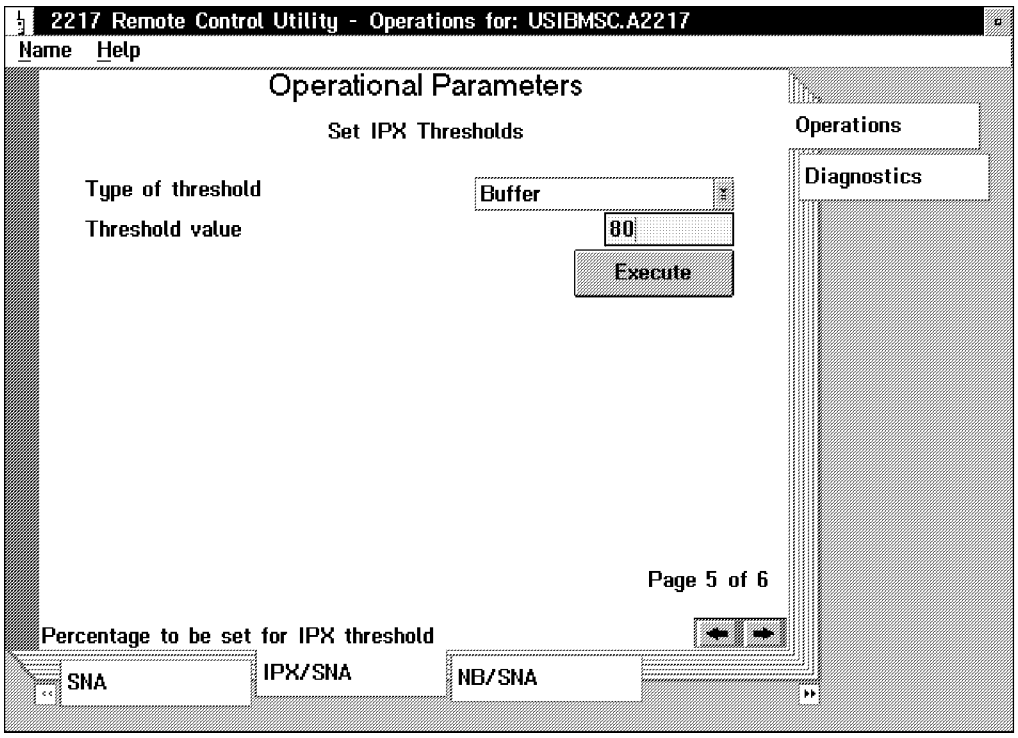


Figure 141. Operational Parameters - IPX/SNA Gateway Operations (Page 5 of 6)

On this panel, you can set a threshold value for the type of threshold selected. Using this option, you can dynamically change the IPX thresholds for the IPX over SNA Gateway function. When the specified value is reached, an alert (log) is issued.

- **Type of threshold:**
  - Buffers
  - SAP entries
  - RIP entries
- **Threshold value:**
  - Enter the percentage for the threshold value.

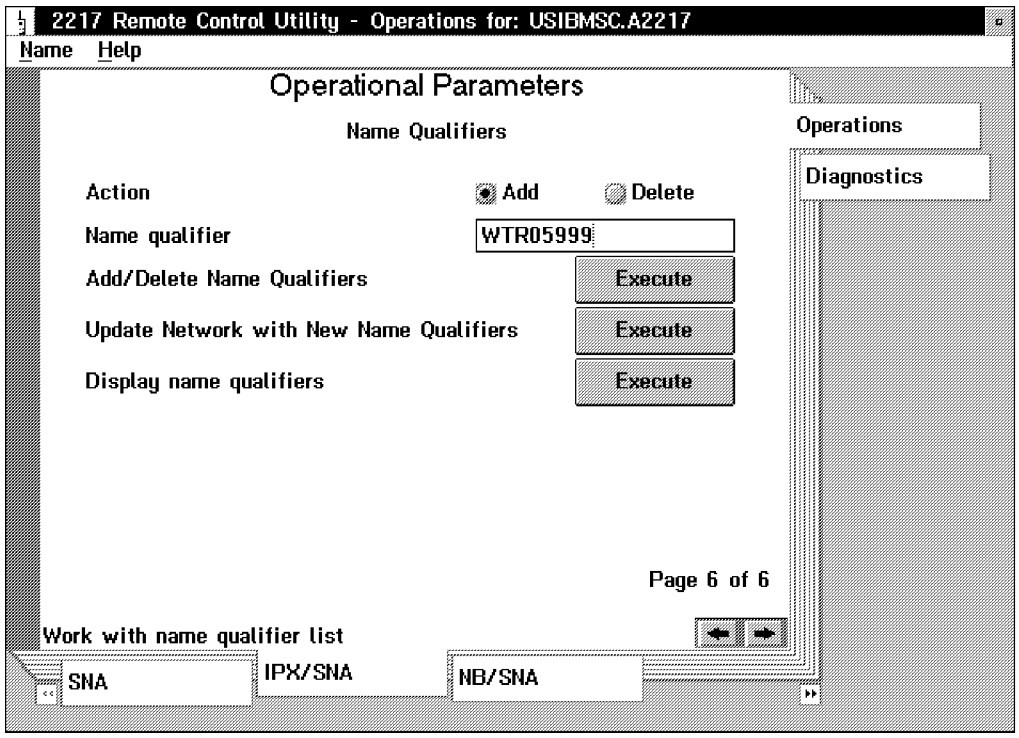


Figure 142. Operational Parameters - IPX/SNA Gateway Operations (Page 6 of 6)

- **Action:** Select this option to initiate the requested action for the specified name qualifier:
  - Add to add the name qualifier (default value)
  - Delete to delete the name qualifier

  Click on the **Execute** push button to initiate the requested action for the specified name qualifier.
- **Name qualifier:** This field specifies the name qualifier used for the IPX over SNA function. The IBM 2217 MpC uses name qualifiers to support the IPX protocol.
- **Add/Delete Name Qualifier:** Click on the **Execute** push button to initiate the requested action for the specified name qualifier.
- **Update Network with New Name Qualifiers:** Click on the **Execute** push button to signal the 2217 to update the network with the new name qualifier list.
- **Display name qualifiers:** Click on the **Execute** push button to view the name qualifier list.

  Note: Name qualifier lists determine to which specific region the IBM 2217 MpC should route session startup or datagram frames. The name qualifier list is required for NetBIOS routing and optional for IPX in providing specific access to NetWare servers. You can apply the name qualifier to NetWare servers if you wish to manage specific access over the WAN.

7.5 Special Considerations

In our sample network, we ran R2 of the 2217 code and had the following APARs applied:

- IR32542 (MX00201A thru MX00201E)
- IR32755
- IR32822

7.6 Problem Determination

In this section, we show where to look for information in order to troubleshoot a configuration problem when running NetBIOS over SNA applications.

7.6.1 Viewing IBM 2217 MpC Log Files

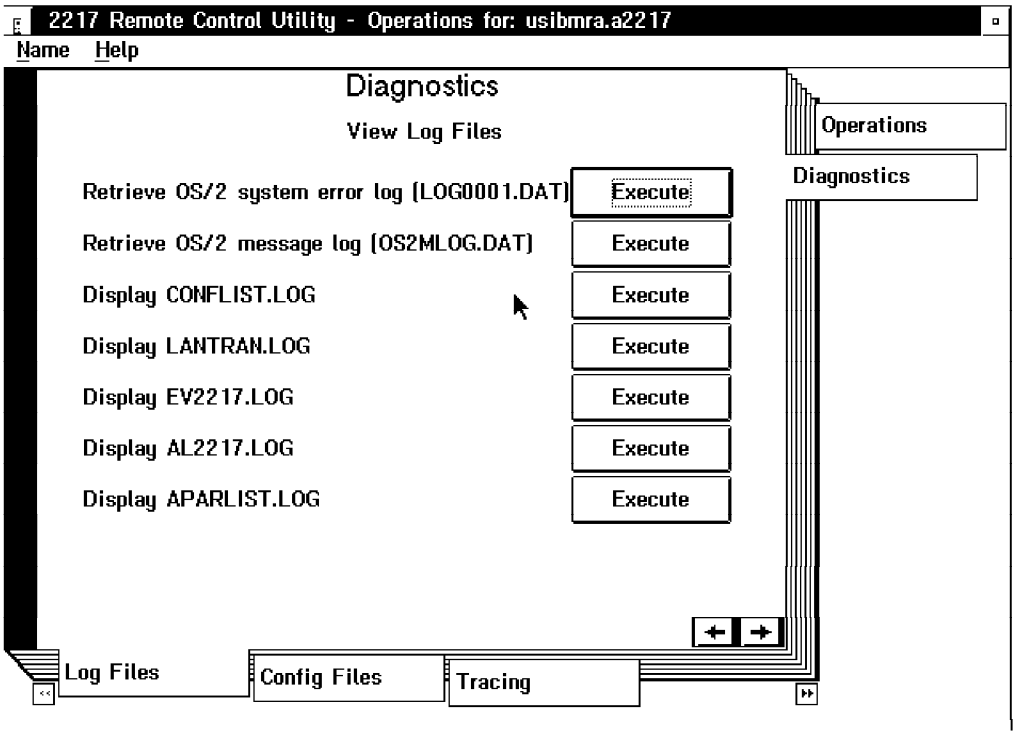


Figure 143. Diagnostics - View Log Files

The following display options are used in this panel as shown in Figure 143:

- **Retrieve OS/2 system error log (LOG0001.DAT):** Click on the **Execute** push button to copy the LOG0001.DAT file to the 2217RCU directory.
- **Retrieve OS/2 system message log:** Click on the **Execute** push button to copy the OS2MLOG.DAT file to the 2217RCU directory.
- **Display the CONFLIST.LOG:** Click on the **Execute** push button to view the CONFLIST.LOG. This file contains a list of the configurations that have been applied to the IBM 2217 MpC.
- **Display the LANTRAN.LOG:** Click on the **Execute** push button to view the LAN information log. In the reply of this command, you find useful information about adapter initialization. For example:

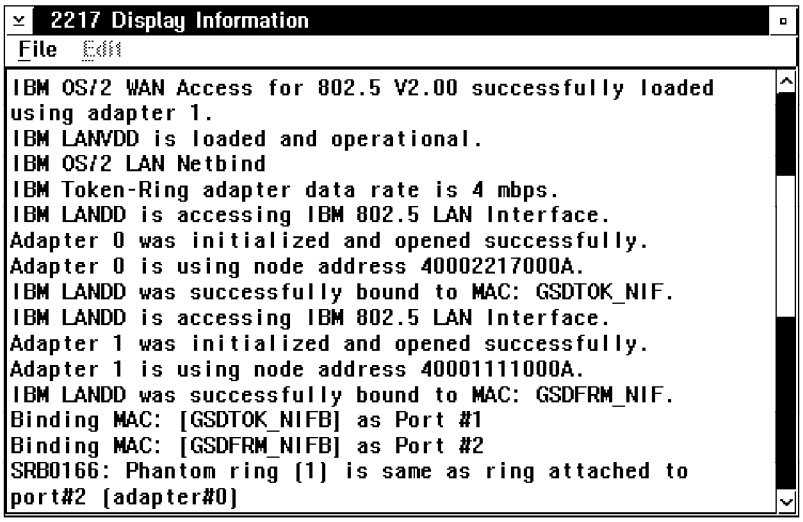


Figure 144. Sample LANTRAN.LOG File

- **Display the EV2217.LOG:** Click on the **Execute** push button to view the Event Message Log on the IBM 2217 MpC (EV2217.LOG). This file contains the events recorded for the NetBIOS and IPX over SNA Gateways. For example:

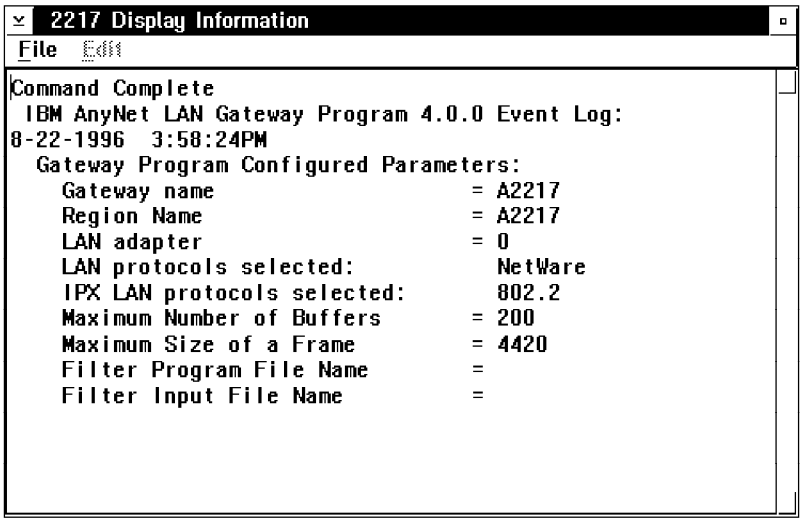


Figure 145. Sample EV2217.LOG File

- **Display the AL2217.LOG:** Click on the **Execute** push button to display the Alert Message Log on the 2217 (AL2217.LOG). This file contains the alerts recorded for the NetBIOS/IPX over SNA Gateways. For example:

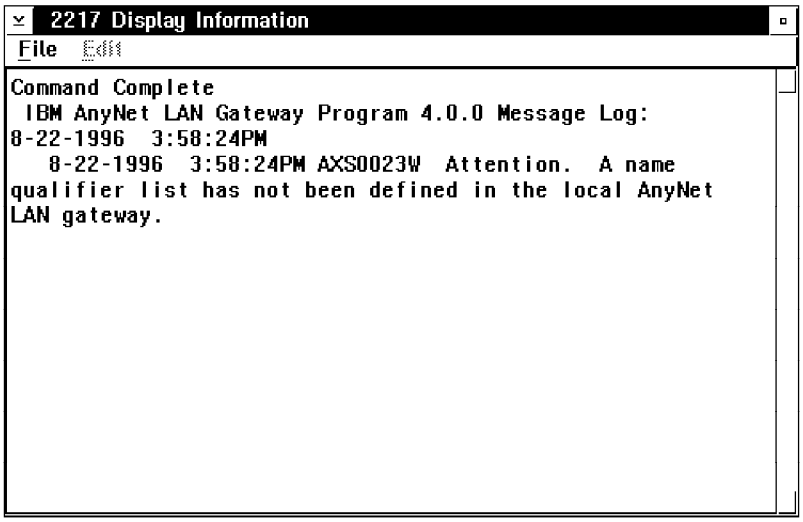


Figure 146. Sample AL2217.LOG File

- **Display the APARLIST.LOG:** Click on the **Execute** push button to view the APARLIST.LOG file. This file contains a list of the APAR fixes that have been applied to the IBM 2217 MpC.

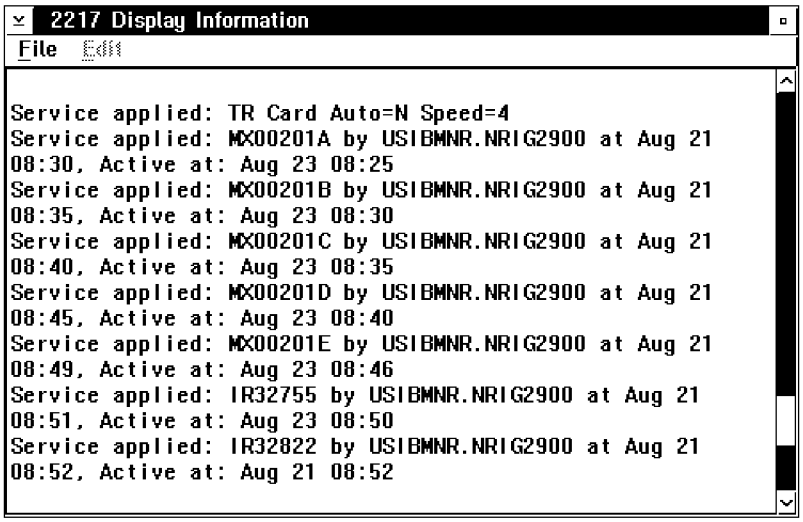


Figure 147. APARLIST.LOG File (Partial View)

7.6.2 Viewing the Configuration Files

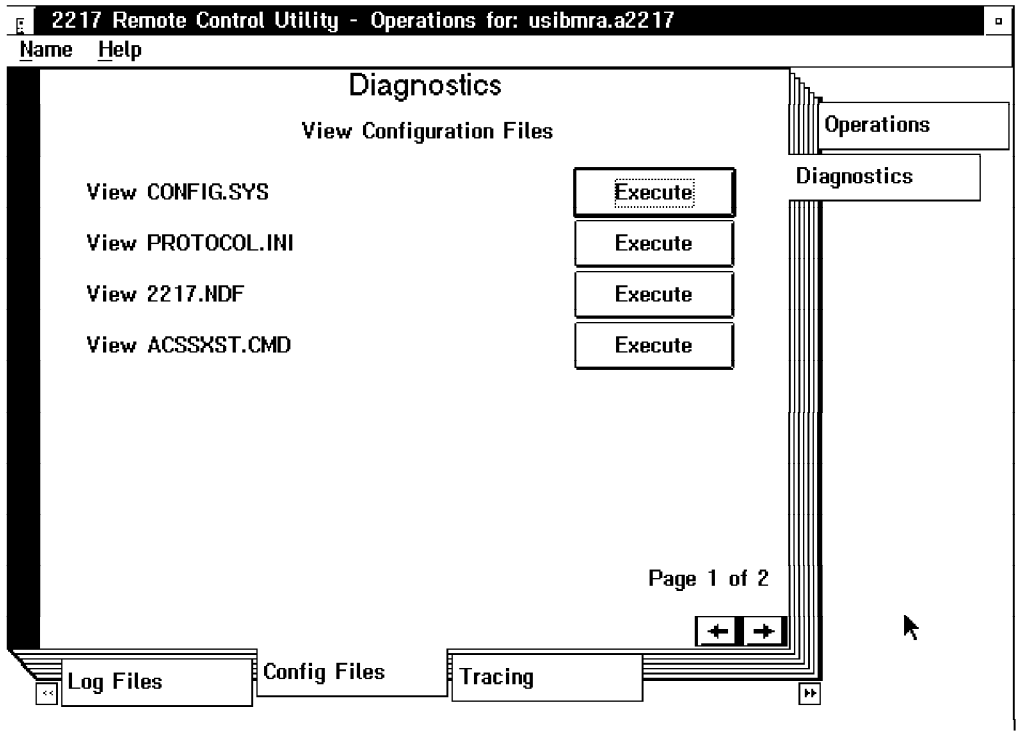


Figure 148. DIAGNOSTICS, Viewing the Configuration Files - The Diagnostics

The following display options are used in this panel as shown in Figure 148:

- **View CONFIG.SYS:** Click on the **Execute** push button to view your CONFIG.SYS file.
- **View PROTOCOL.INI:** Click on the **Execute** push button to view your PROTOCOL.INI file.
- **View 2217.NDF:** Click on the **Execute** push button to view the 2217.NDF file.
- **View ACSSXST.CMD:** Click on the **Execute** push button to view the ACSSXST.CMD file. However, this configuration file does not apply to the IPX over SNA function.

7.6.3 Tracing IPX over SNA Name Qualifiers

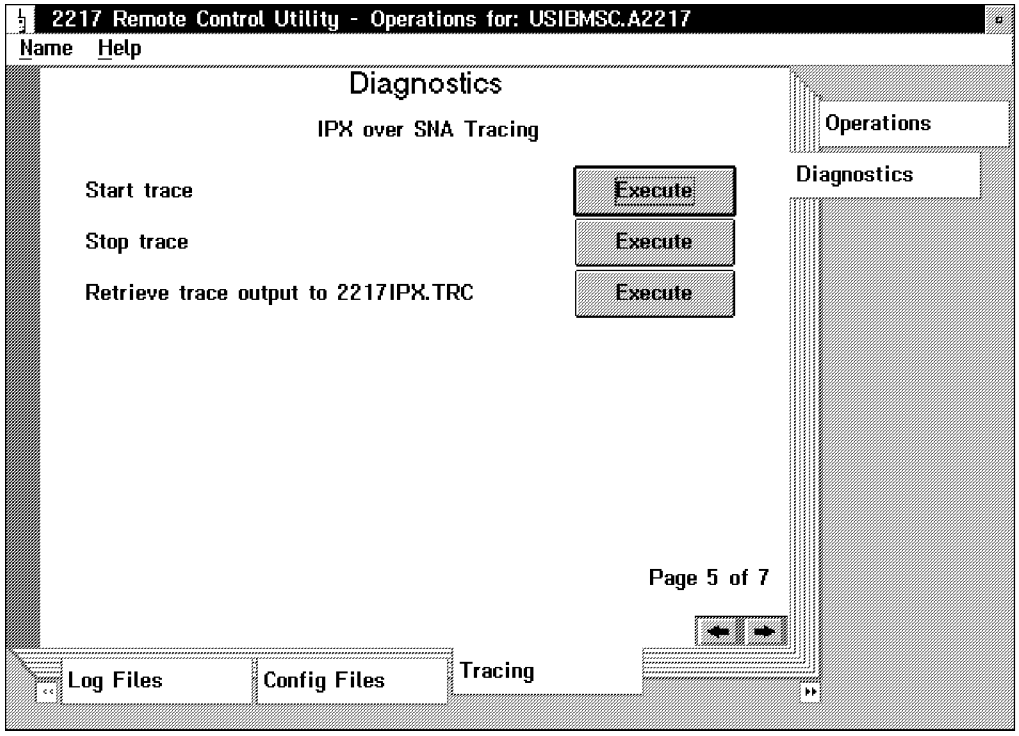


Figure 149. Diagnostics - IPX over SNA Tracing

The following event options are used in this panel as shown in Figure 149:

- **Start trace:** Click on the **Execute** push button to begin a trace.
- **Stop trace:** Click on the **Execute** push button to stop a trace in progress.
- **Retrieve trace output to 2217IPX.TRC:** Click on the **Execute** push button to copy the results of an IPX over SNA trace.

Part 5. WAN Data Link Control

Chapter 8. SDLC Data Link Control - Configuration

The IBM 2217 MpC currently offers you a choice of four wide area data transport protocols: SDLC, X.25, frame relay and ISDN. In this chapter, we focus on SDLC support and examine more closely the steps through the RCU panels that will eventually lead to a complete configuration. We show you a sample configuration for an SDLC-based network of 2217s on the WAN link.

8.1 Scenario Description

To illustrate a potential customer setup, we connected three 2217s, where all three were attached to different LANs. In general, it is possible to use all functions of the 2217 (offering transport for pure SNA data, as well as NetBIOS, IPX, and IP) concurrently over the same link. However, to simplify the configuration process, we configured for a subset of functions only, using a different WAN DLC one at a time. The SDLC configuration presented in this chapter is used to transport NetBIOS and IPX data across the WAN. The NetBIOS-specific configuration may be reviewed in Chapter 6, “NetBIOS Applications over SNA” on page 145.

8.1.1 Configuring the WAC Adapter for SDLC

To begin with, you configure the LAN and WAN adapter profiles, before dealing with other options. We skip the settings for the LAN adapter here, as it is independent from SDLC. When you click on the **WAC 1-0** tab at the bottom of the panel, you will be presented a configuration panel, where you may select the DLC that is going to be used for this port, as well as configure the line parameters (as shown in Figure 150).

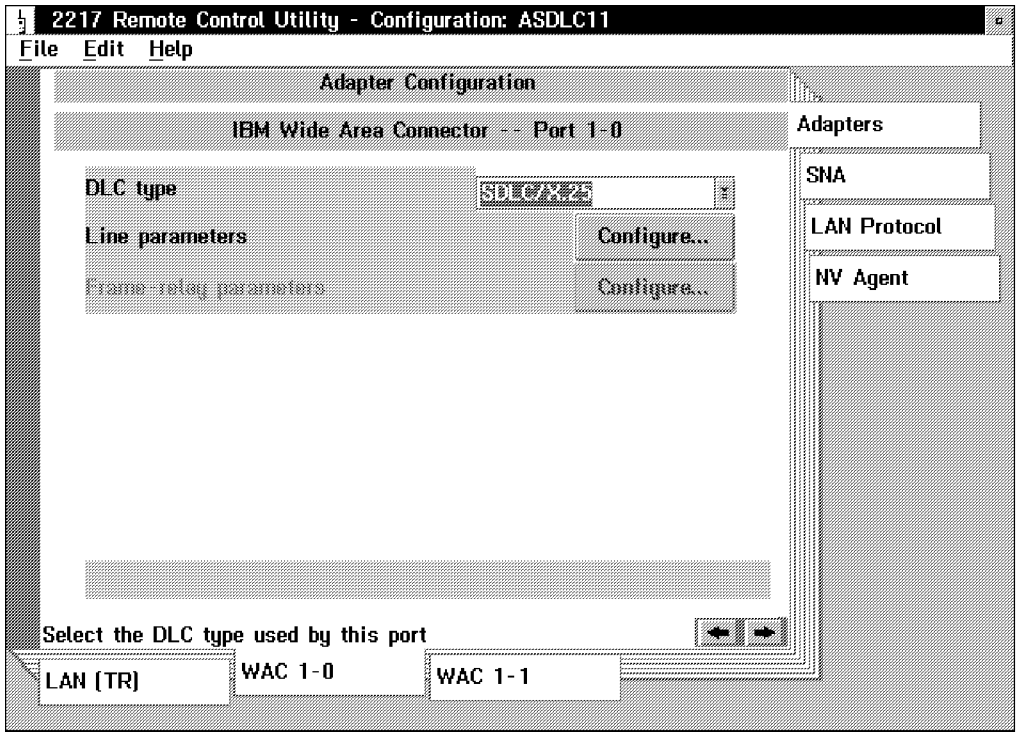


Figure 150. RCU Adapter Section - WAC Port 1-0

Here is a list of the parameters that you are required to set:

- **Line Speed:** The line speed is usually determined by your network supplier, and you have to set it accordingly. The range of potential line speeds is marked by 1200 bps as the lowest and 2 Mbps as the highest possible value. We selected 512 kbps for the link between 2217 A and 2217 B.
- **Permanent request to send?:** This radio button specifies whether half-duplex transmission facilities or full-duplex transmission facilities are used:
  - Specify Yes for constant Request to Send (RTS). Most modern communications facilities are full-duplex and require constant RTS for point-to-point lines and the primary end of SDLC lines.
  - Specify No for switched RTS (Line Turnaround Required) if either half-duplex communications facilities are being used or the line is the secondary end of a multidrop SDLC line.
- **NRZI?:** This specifies whether the 2217 uses the non-return-to-zero inverted (NRZI) algorithm on this particular line. This setting has to match the setting on the partner side. If you connect a 2217 to an NCP, check the NCP's line definition for this parameter first. Because we are connecting 2217s to each other, we may chose either one, and have opted for NRZ, which is basically non-NRZI.

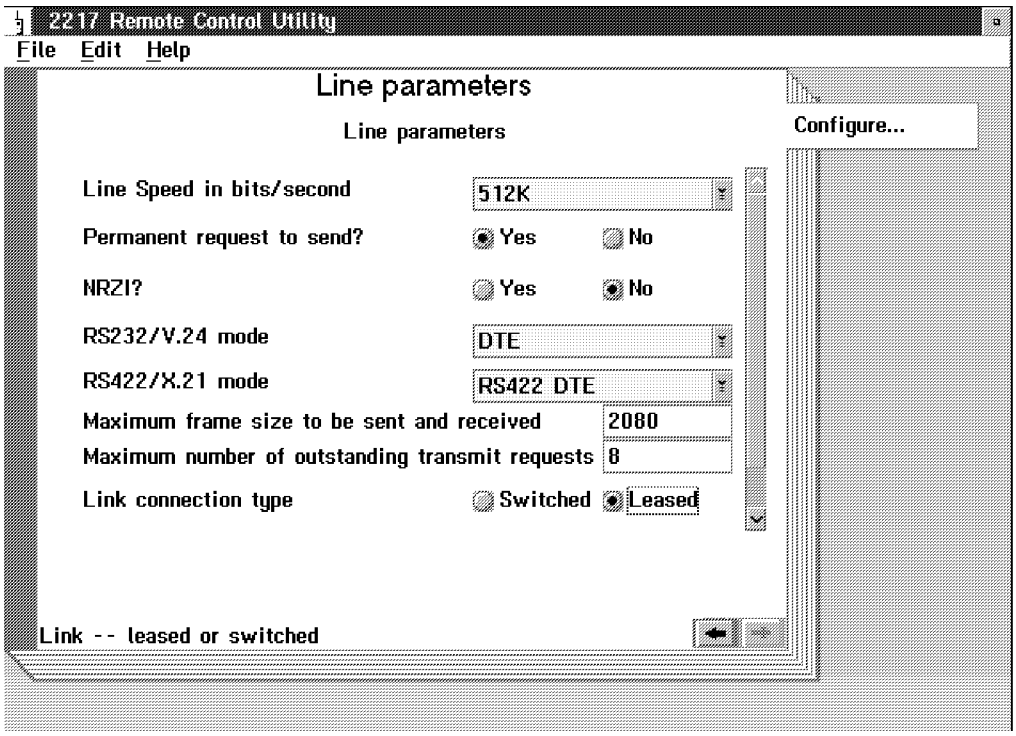


Figure 151. WAC Port 1-0 Configuration - Line Parameters

- **RS232/V.24 mode:** When you order the 2217, you have to specify which interface you would like to use on which port. Keep in mind that the RS232/V.24 interface supports line speeds of up to 19.2 kbps only. Depending on how your WAC adapter is equipped (it is either an RS232/V.24 or an RS422/X.21 or a V.35 interface). If the WAC port 1-0 in your 2217 is equipped with the RS232/V.24 socket, you have the following options (as listed in the RCU help text):

This field specifies the clocking modes used if the RS232/V.24 card is installed:

- DTE when connected to a modem that generates the clocking.
- DTE pin24 TXC when connected to a modem that requires the DTE to generate Tx clock on pin 24.
- DCE when the WAC provides both Rx and Tx clocks. (DCE mode requires the use of a crossover adapter described in the *2217 Planning Guide*.)

Note

When your WAC adapter is equipped with a V.35 interface for port 1-0 (the same holds true for port 1-1, by the way), none of these settings apply, as they are overridden by the V.35 mode.

- **RS422/X.21 mode:** As stated earlier, this parameter applies when the WAC port 1-0 is equipped with this interface only.

  This field specifies the clocking modes used if the RS422/X.21 card is installed:

  - RS422 DTE mode. This mode requires the RS422 cable.
  - X.21 DCE TxC_Echo mode. The attached DTE must echo the clock on the B line to be used for clocking data into the Wide Area Connector. This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.
  - Normal X.21 DCE mode. This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.
  - Normal X.21 DTE mode.
  - X.21 DTE TxC_Echo mode. The clock received on the S line is echoed on the B line to eliminate Tx clocking skew on long cables.

- **Maximum frame size to be sent and received:** Here as well, the RCU help has a concise explanation to offer:

  The default is 4486 for the frame relay network, and 2080 for SDLC and X.25. If you specify DEFAULT for WAC, the RCU selects 4486 or 2080, depending on the DLC Type specified (range: 256-8000).

  This field specifies the maximum size data frame that can be processed. It is used by the MAC driver to allocate buffers and must be set larger than any expected data and header size used by the higher protocol. However, if it is set unnecessarily high, buffer space is wasted. In particular, this value must be larger than the Maximum I-Field Size specified in the SNA DLC Characteristics panel for this port:

  - For all interface types except X.25, a value 20 bytes larger than the Maximum I-Field Size is recommended.
  - For X.25 interfaces, a value 10 bytes larger than the maximum packet size used on any virtual circuit is recommended.

- **Maximum number of outstanding transmit requests:** This specifies how many transmit requests the device driver that is associated with this link will be able to queue internally. The value may range from 1 to 20; the default is 8.
- **Link connection type:** Here you specify if the link is a permanent or a switched connection. This has some influence on the way your SNA links are configured. See configuration panel shown in Figure 154 on page 198.

- **Accept incoming calls?:** This parameter is enabled only if you previously selected **Switched**. When it is set to No, you will be able to use this WAC port for outgoing switched SDLC connections only (which might be a valid option for different reasons).

8.1.2 Configuring SDLC-Related Parameters in the SNA Info Section

Figure 152 shows the configuration panel for the basic SNA characteristics. We included this figure to show you the Execute button in the SNA Link Definitions field. When you click on the **Execute** button, you will get a panel similar to Figure 107 on page 149. Click on **Add** or **Edit** there, and a panel similar to Figure 153 on page 197 will open.

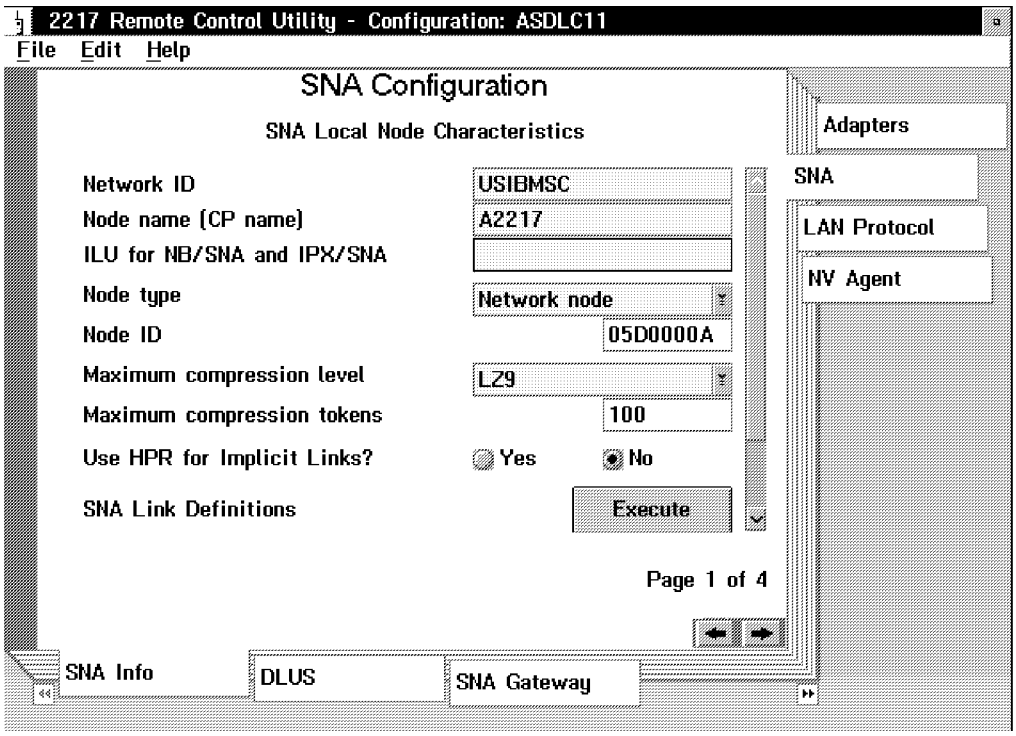


Figure 152. SNA Configuration - SNA Local Node Characteristics

8.1.3 Configuring SNA Links for SDLC

To create an additional link, or edit an existing one, you have to adjust the following parameters (they are distributed over this and the Additional Link Parameters panel).

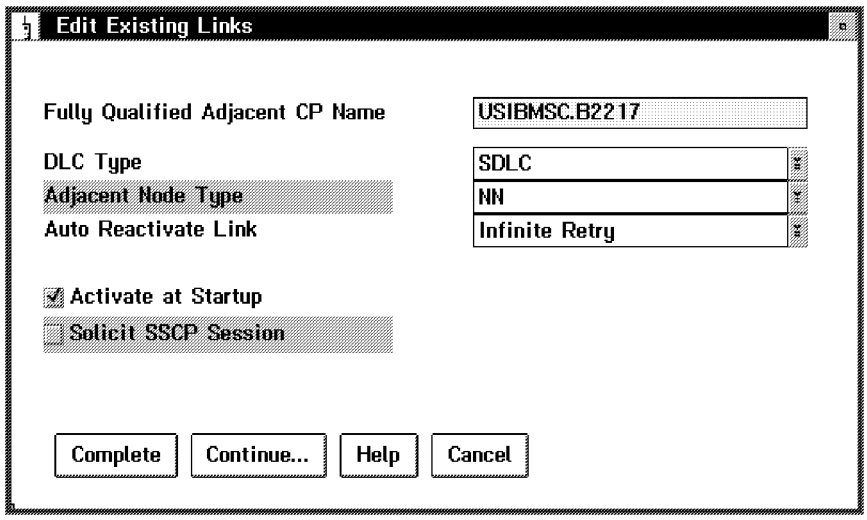


Figure 153. SNA Links - Edit Existing Links

- **Fully Qualified Adjacent CP Name:** This, of course, is the CP name of the 2217 on the other end of the link for which you are configuring.
- **DLC Type:** Again, you may select Ethernet, Token Ring, Frame Relay, SDLC or X.25. We selected SDLC.
- **Adjacent Node Type:** As you may configure for SNA links to a number of different nodes, you may not always be aware of their APPN capabilities at this stage of configuration. Therefore, you may select one of three different adjacent node types: EN, NN and LEARN. The latter means that the 2217 learns about its partners APPN capabilities during the XID exchange. Because we set up all 2217s as network nodes, we specify NN.
- **Auto Reactivate Link:** It appears to us to be a safe recommendation to specify Infinite Retry here. This will cause the 2217 to try to reestablish an SNA link that has been interrupted. However, the DLC used on this link has to be active. This option does not reactivate a broken DLC or an adapter that has been closed.
- **Activate at Startup:** This option is a slightly misleading in that it does not clearly state that Activate at Startup means *only at startup*. If the link will be interrupted later, the 2217 will not attempt to restart it. If you want an application to be able to start the link, do not check this box (this declares the link to be ready to start on demand).
- **Solicit SSCP Session:** If you require your partner to be your SNA Gateway and provide you with an SSCP-PU session (because you configure for the SNA Gateway in this 2217 as well), check the Solicit SSCP Session box. Otherwise, leave it unchecked.

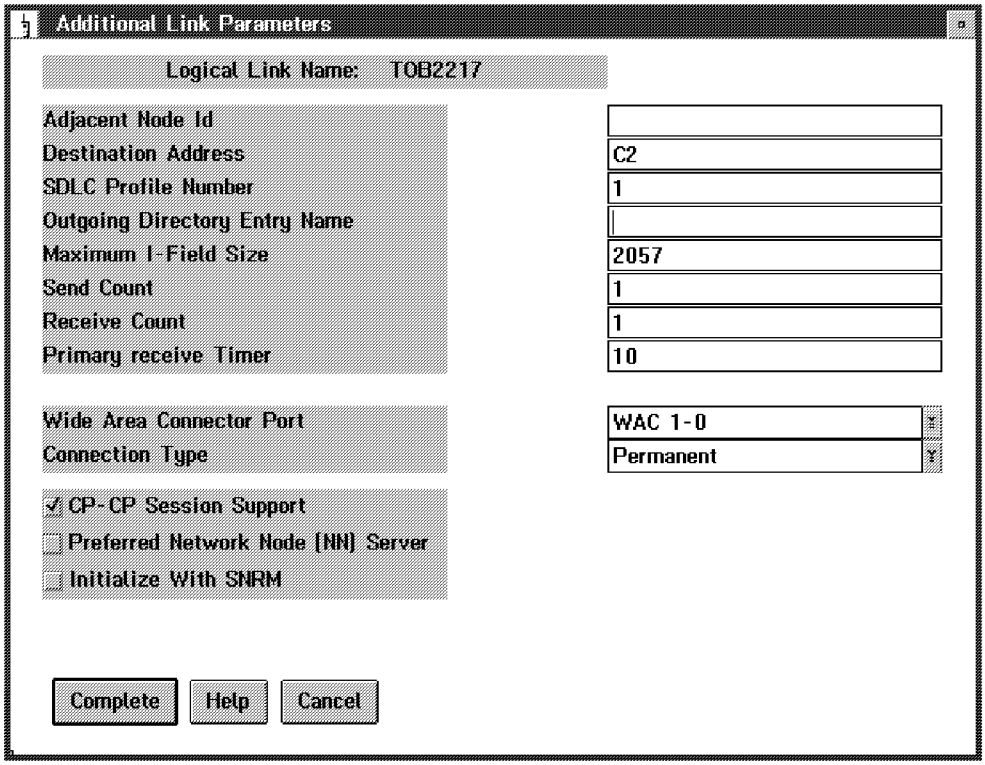


Figure 154. SNA Links (SDLC) - Additional Link Parameters (Permanent Link)

Because SDLC is specified as the DLC Type in Figure 153 on page 197, there are a number of other settings that you must check. In more detail, these are:

- **Adjacent Node Id:** There are at least two ways that your partner SDLC station will be able to determine your authorization to connect during XID exchange: you either supply both stations with a unique node ID (formerly known as IdBlk/IdNum), or you specify a destination address (see below). If you opt for node IDs, you will have to specify your own node ID when configuring the SNA local node characteristics (SNA section) and your partner's node ID. The node ID consists of eight bytes, and it is in hex format. The default is 05D00000. Make sure that the first three bytes (the former IdBlk) are the same on both machines.
- **Destination Address:** If you decide to provide destination addresses rather than node IDs, enter a two-byte hexadecimal value. During XID exchange, where both SDLC stations were configured as Negotiable, the value configured here determines whether this station will become Primary or Secondary. Note that this is always the Secondary Station Address:
  - When this workstation is configured to be Primary, the value entered here becomes the secondary station address of the partner.
  - When this workstation is configured to be Secondary, the value entered here becomes its own station address.
- **SDLC Profile Number:** This may be a number between 1 and 127. As you specify the profile number, be certain to use the same number(s) when configuring the actual SDLC DLC (see Figure 155 on page 200 and Figure 156 on page 200).

- **Outgoing Directory Entry:** This has to be specified when a switched SDLC link is used. Specify the name of the entry that contains the partner's SDLC modem number.
- **Maximum I-Field:** Specify a value between 265 and 4105. Make sure the value matches the one configured for the SDLC DLC (see Figure 157 on page 201).
- **Send Count:** This value determines whether to use the Modulo 8 or Modulo 128 algorithm (1-7 is for Modulo 8, 8-127 is for Modulo 128).
- **Receive Count:** See Send Count.
- **Primary Receive Timer:** Specifies in tenths of seconds the time span that the Primary station will wait for a frame from the Secondary station.
- **Wide Area Connector Port:** Select which port the link is to use.
- **Connection Type:** Select either Permanent or Switched, according to your needs.
- **CP-CP Session Support:** Check, if required. For a detailed explanation on CP-CP sessions in general, see the *APPN Architecture and Product Implementations Tutorial*, GG24-3669.
- **Preferred Network Node Server:** This applies only when the 2217 itself is configured as an end node. In this case, you might want to register the 2217 as an end node to the network node on the SDLC link by default.
- **Initialize with SNRM:** SNRM means Set Normal Response Mode. If this box is checked, XID exchange is bypassed, and the 2217 tries to get in normal response mode immediately.

8.1.4 Configuring the SDLC DLC Profiles

Figure 155 on page 200 shows the SDLC DLC Characteristics summary or overview panel. By default, no DLCs are displayed. Still there is an SDLC profile in every configuration (profile number 0), which cannot be changed or deleted. The profile number 0 allows for a dial-in connection to the 2217 in case of a failure of the primary WAN link. On the panel shown in Figure 155 on page 200, you may browse the settings of all fields that belong to a profile by using the scroll bar. To edit a particular profile, mark the respective line and click on **Edit**; to add a profile, click on the **Insert after** or **Insert before** button.

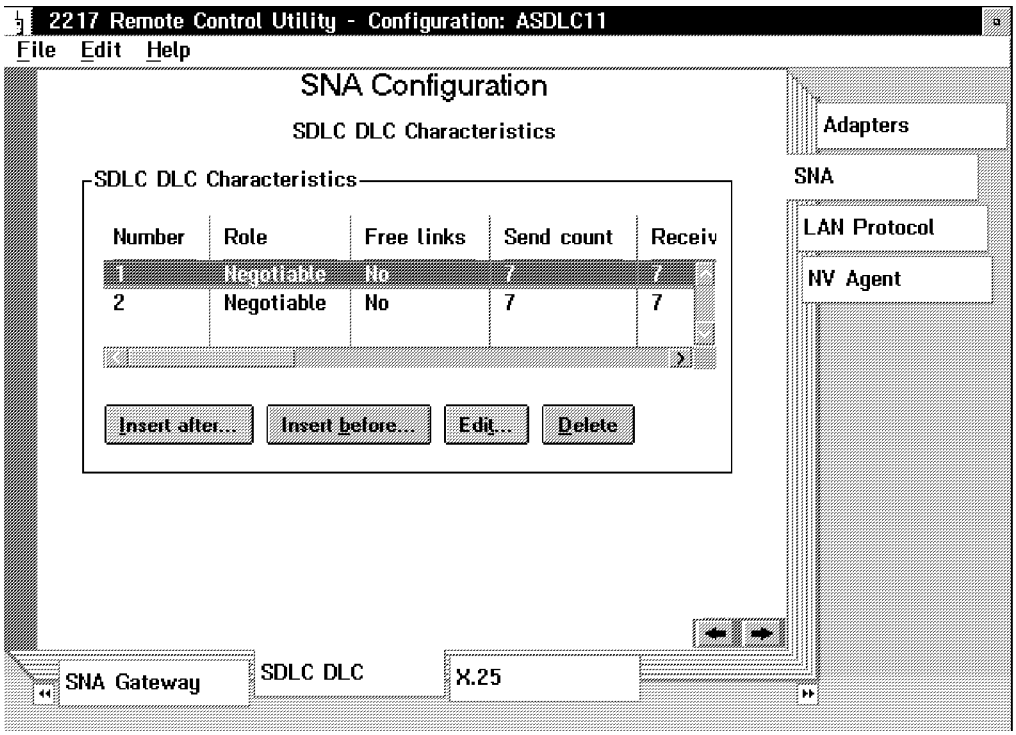


Figure 155. SDLC DLC Characteristics (Overview)

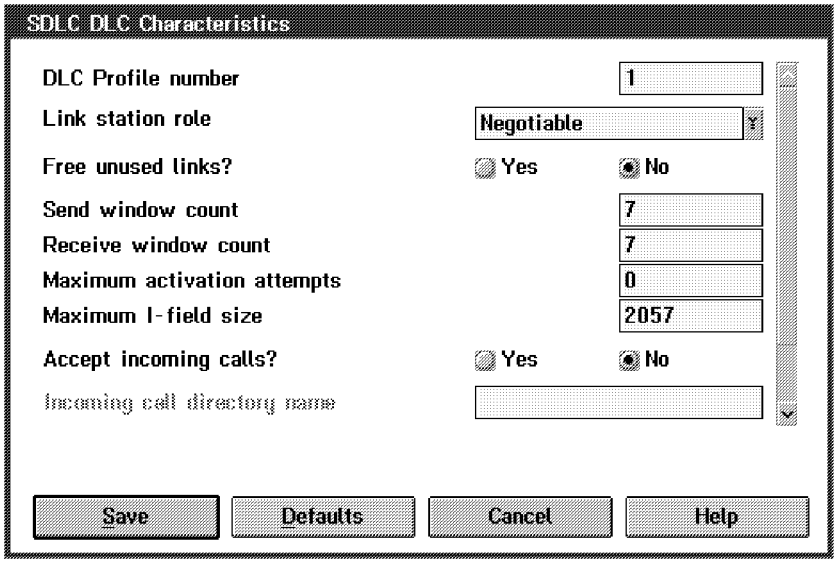


Figure 156. SDLC DLC Characteristics Detail View - DLC Profile No. 1, Part 1

Figure 156 and Figure 157 on page 201 show the SDLC DLC Characteristics in edit mode. (Both figures overlap to a great extent, but as the size of the panel cannot be modified, we decided to take this approach to include a view of all entry fields here).

Here is an explanation of each individual entry field:

- **DLC Profile number:** This is simply a number to match a certain DLC profile to a link (see SNA link configuration in Figure 154 on page 198). Although

you will use 1 for the first profile you configure, this is optional. The range is between 1 and 127.

- **Link station role:** If you want to predetermine the role, select either Primary, Multipoint Primary, or Secondary. Otherwise, leave the default Negotiable.
- **Free unused links?:** If this is a costly switched connection, you might want to take the link down when no application makes use of it. In this case, select the **Yes** button. If this is for a non-switched SDLC link, we recommend you select **No** to save the time for link reestablishment.
- **Send window count:** This value determines how many frames this station sends to its partner before it expects an acknowledgment. It is part of the data flow control on the link level and may not be confused with session level pacing. During XID3 exchange, this value will be dynamically updated to reflect the partner stations Receive window count.
- **Receive window count:** This value determines how many frames the station will receive before it sends out an acknowledgment.
- **Maximum activation attempts:** If you want to limit how often this station tries to activate the DLC at startup time, enter a number here. Zero (0) means that the station will try to activate the DLC continually.
- **Maximum I-field size:** This is the maximum RU size plus 9 bytes that this DLC is supposed to handle. Make sure it matches the value that had been assigned to the equivalent field in the SNA link definition.

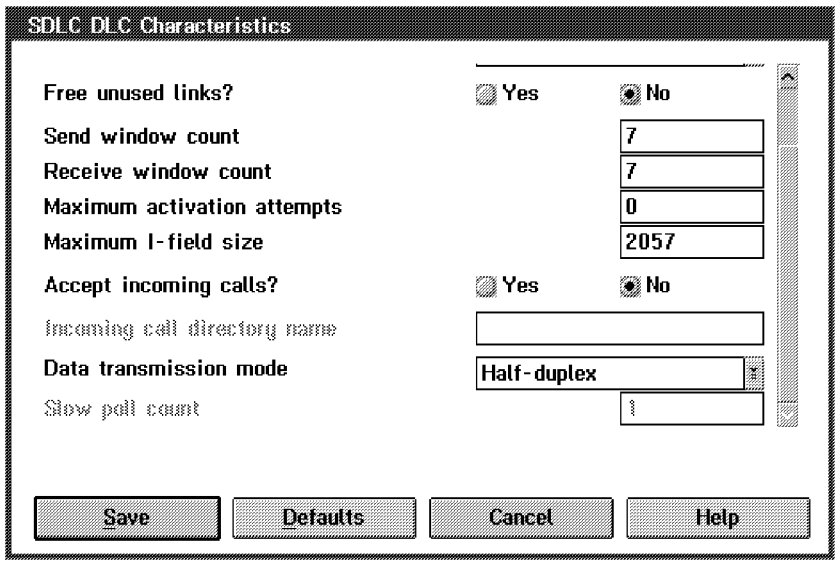


Figure 157. SDLC DLC Characteristics Detail View - DLC Profile No. 1, Part 2

- **Accept incoming calls?:** If you want this DLC to be able to react on incoming calls (that is, when another 2217 attempts to use this DLC to activate a link), you have to select **Yes** here.
- **Incoming call directory name:** If you selected Yes for the above field, then you also have to specify an incoming call directory (see Figure 157).
- **Data transmission mode:** Specify either half-duplex or full-duplex.
- **Slow poll count:** If link station roles is multipoint primary, this field specifies number of times synchronous data link control (SDLC) goes through the active list before polling a station on the inactive list. Default value is 1.

8.1.5 Configuring for Switched (SDLC) Connections

In this section, we show what is required to configure a switched SDLC link. Basically, you will need to select a switched connection in the configuration panels. In addition, an outgoing or incoming call directory or both must be supplied.

8.1.5.1 Incoming Call Directory

In general, an incoming call directory is used to limit the potential connections between the 2217 and other SDLC-connected workstations to certain caller numbers. In the 2217, it is used to make WAC ports available for incoming connections. The only thing you can specify here, besides the call directory name, is the port for which it can be used. Figure 158 gives an example of the Incoming Call Directory Entries overview panel.

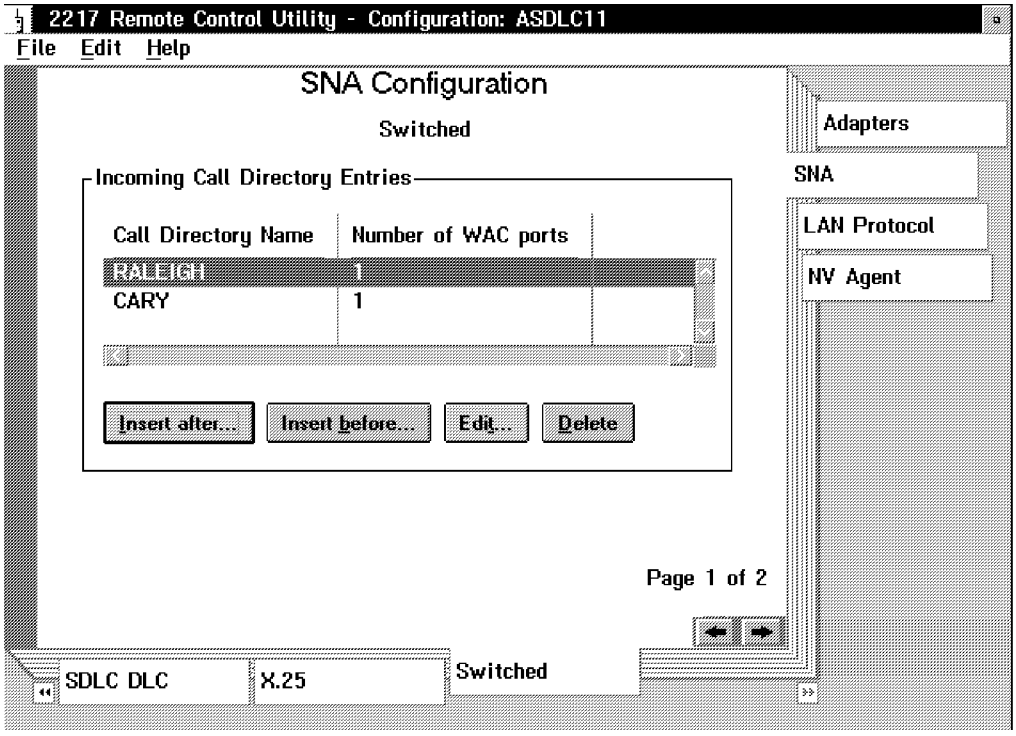


Figure 158. SNA Configuration for Switched Connections - Incoming Call Directory Entries (Overview)

8.1.5.2 Outgoing Call Directory

Outgoing Call Directory Entries need to be specified for any switched SDLC connection. Therefore, you will have to enter at least one entry name here, as well as select NRZ or NRZI as the encoding scheme, and provide the modem number of your partner 2217. Figure 159 on page 203 gives an example of the Outgoing Call Directory Entries overview panel. As there have been no called parties modem numbers supplied yet, the sample entry SDLCOUT may in effect not be used in this configuration.

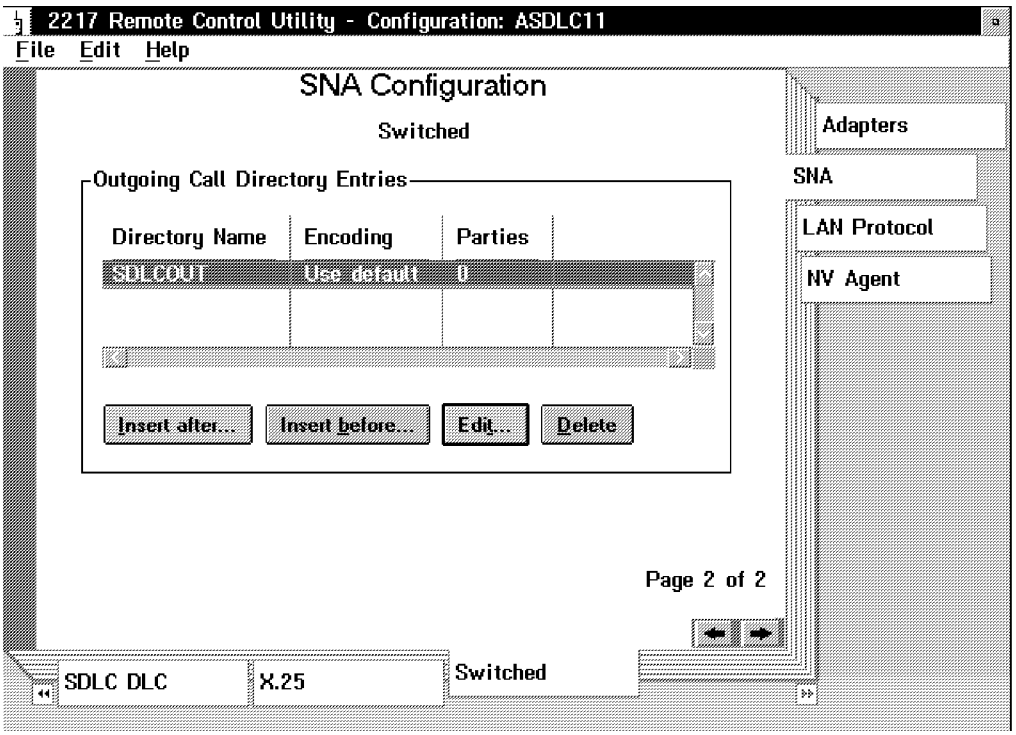


Figure 159. SNA Configuration for Switched Connections - Outgoing Call Directory Entries (Overview)

8.1.6 Problem Determination for SDLC

If connectivity problems occur at an SDLC-attached 2217, you will be able to start a trace on the 2217 from your RCU workstation. This function can be found on page 1 of the tracing subsection of the Diagnostics section, when you execute the Operations and Administration of Remote 2217 MpC. Figure 175 on page 219 shows an example of this panel. Keep in mind that you will have to connect your RCU workstation to the failing 2217 either through the dial-in SDLC link (profile 0) or through LAN connectivity in this case.

8.1.7 Special Considerations

Although we previously described the configuration of the SDLC DLC in detail, there are a couple of items that may not be configured at all, but are virtually hard coded in the 2217. These items include the Transmission Group settings and the class of service (COS) characteristics. In most cases, this is not a working restriction. You may want to consider that the SDLC DLC defaults to NONSECURE, and that the IBM supplied LU 6.2 modes (#INTERCS and #BATCHCS) that request compression will not work without modification. This is because they use the COS #INTERSC and #BATCHSC, respectively, which require a secure link. We recommend that you create your own LU 6.2 mode if you would like to use compression over an SDLC link.

Chapter 9. X.25 Data Link Control - Configuration

In this chapter, we focus on X.25 and examine more closely the steps through the RCU panels that will eventually lead to a complete configuration. We show you a sample configuration where the 2217s use the X.25 protocol on the WAN link. Of course, you may configure one WAC port for SDLC and another one for X.25, and use them concurrently.

9.1 Scenario Description

To illustrate a potential customer setup, we connected three 2217s, where all three were attached to different LANs. In general, it is possible to use all functions of the 2217 (offering transport for pure SNA data, as well as NetBIOS, IPX, and IP) concurrently over the same link. However, to simplify the configuration process, we configured for a subset of functions only, using a different WAN DLC one at a time. The X.25 configurations presented in this chapter were used to transport NetBIOS and IPX data across the WAN. The NetBIOS-specific configuration may be reviewed in Chapter 6, “NetBIOS Applications over SNA” on page 145.

9.2 Configuring for X.25

In this part of the chapter, we look into the different profiles necessary to establish a connection over an X.25 packet-switched network. The scenario is basically the same as described at the beginning of this chapter: three 2217s connected to each other, using X.25 connections to transport NetBIOS, IPX and IP data from one LAN to another. See Figure 160 for a graphic representation of our test setup.

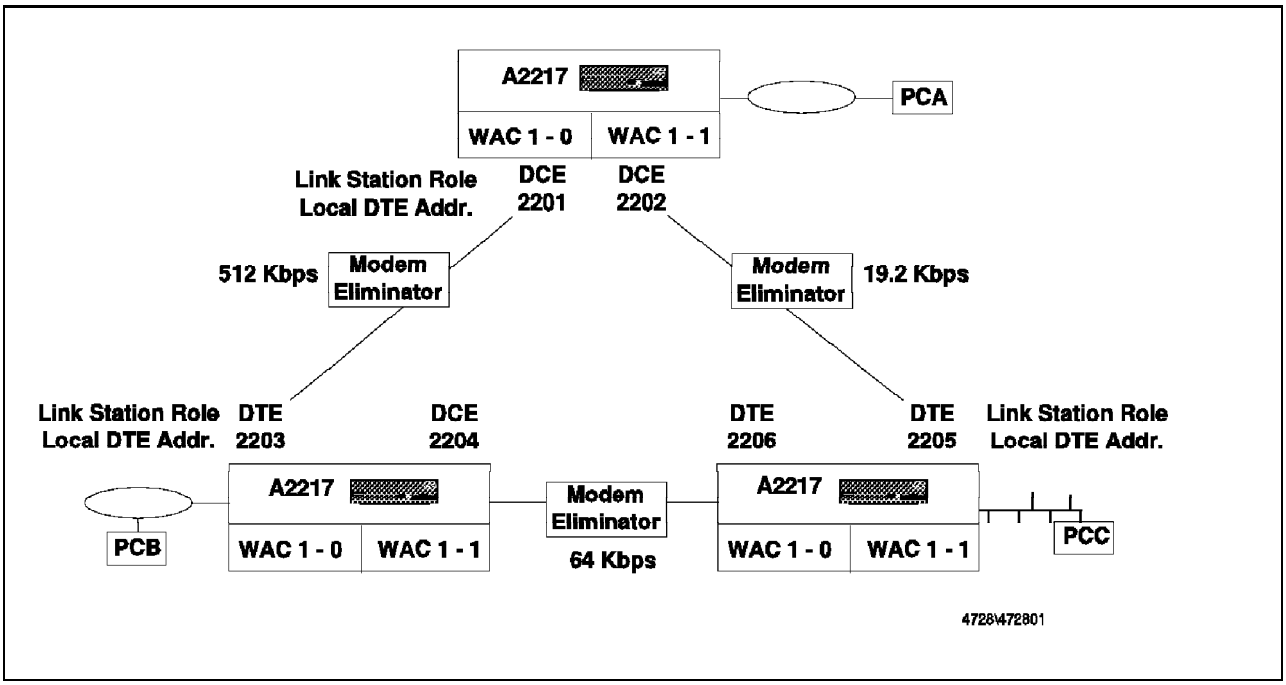


Figure 160. Configuring for X.25 - Scenario Overview

9.2.1 Configuring the WAC Adapter(s) for X.25

When starting the configuration process for a new or existing configuration, you will always be presented the LAN adapter configuration panel first. Click on the **WAC 1-0** tab on the bottom of the page and select **SDLC/X.25** as the DLC type on the next panel. Next click on **Configure...** for Line parameters (as shown in Figure 161).

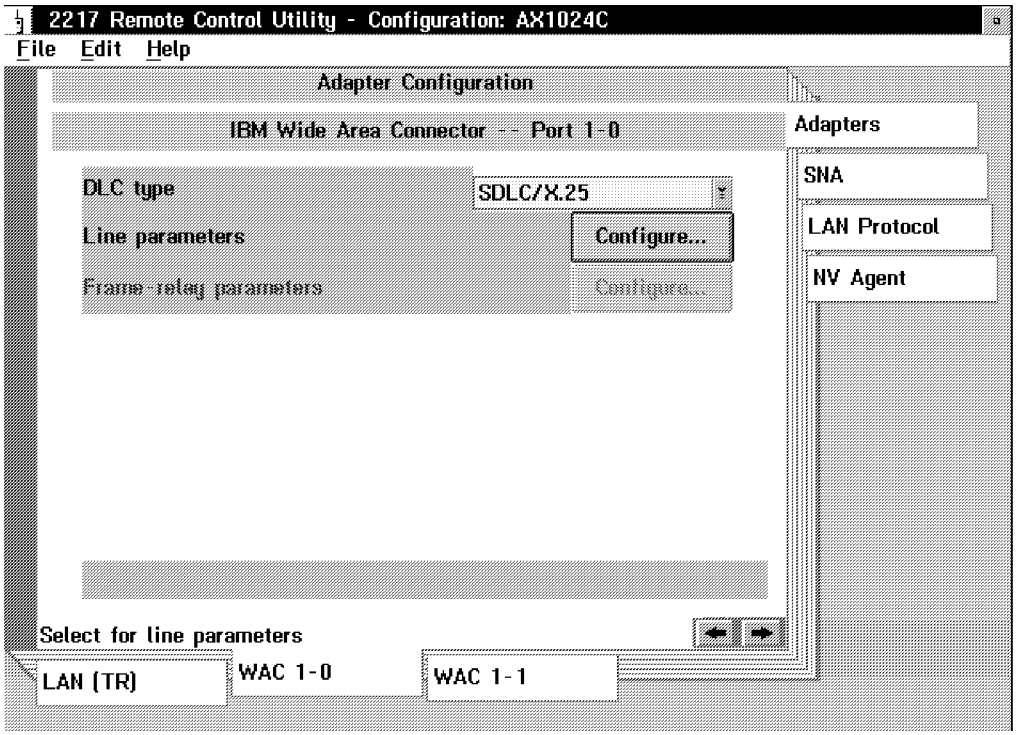


Figure 161. Adapter Configuration - IBM Wide Area Connector -- Port 1-0

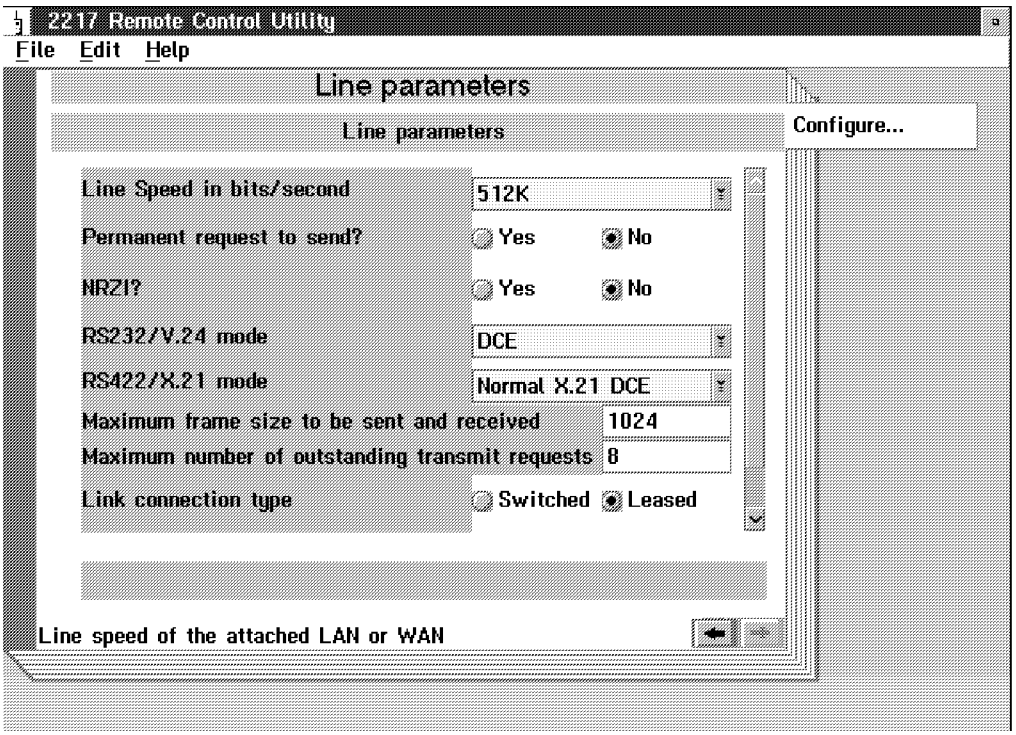


Figure 162. Adapter Configuration - Line Parameters

As shown in Figure 162, the parameters that have to be configured here are very similar or equal to the ones we configured for SDLC (see Figure 151 on page 194), so we focus on the differences here.

- **Permanent request to send?:** Select **Yes** for constant Request to Send (RTS). Select **No** for switched RTS (Line Turnaround Required). For a point-to-point connection using a modem eliminator between two 2217s, we set this parameter to No.
- **RS232/V.24 mode:** When you connect two 2217s to each other, using a cross-over cable or a device that does not act as a DCE, and your WAC 1-0 port is equipped with an RS232/V.24 interface, make sure that this parameter is set to DCE on one of the 2217s. Otherwise, leave the default value. If this WAC port is equipped with a V.35 interface, this parameter, as well as the next one, will be ignored.
- **RS422/X.21 mode:** When you connect two 2217s to each other, using a cross-over cable or a device that does not act as a DCE, and your WAC 1-0 port is equipped with an RS422/X.21 interface, make sure that this parameter is set to DCE on one of the 2217s. Otherwise, leave the default value.

9.2.2 Configuring the X.25 DLC, Links and PVCs

Most of the configuration data necessary to support the 2217s attachment to an X.25 network has to be provided through the following panels. Because the relation between X.25 Links, PVCs, SVCs, Directory Entries, etc. may be confusing at first sight, it may be helpful to use IBM 2217 Nways MpC User's Guide, Release 2, Chapter 7, "Using the 2217 RCU to Configure SNA Connections" for related information.

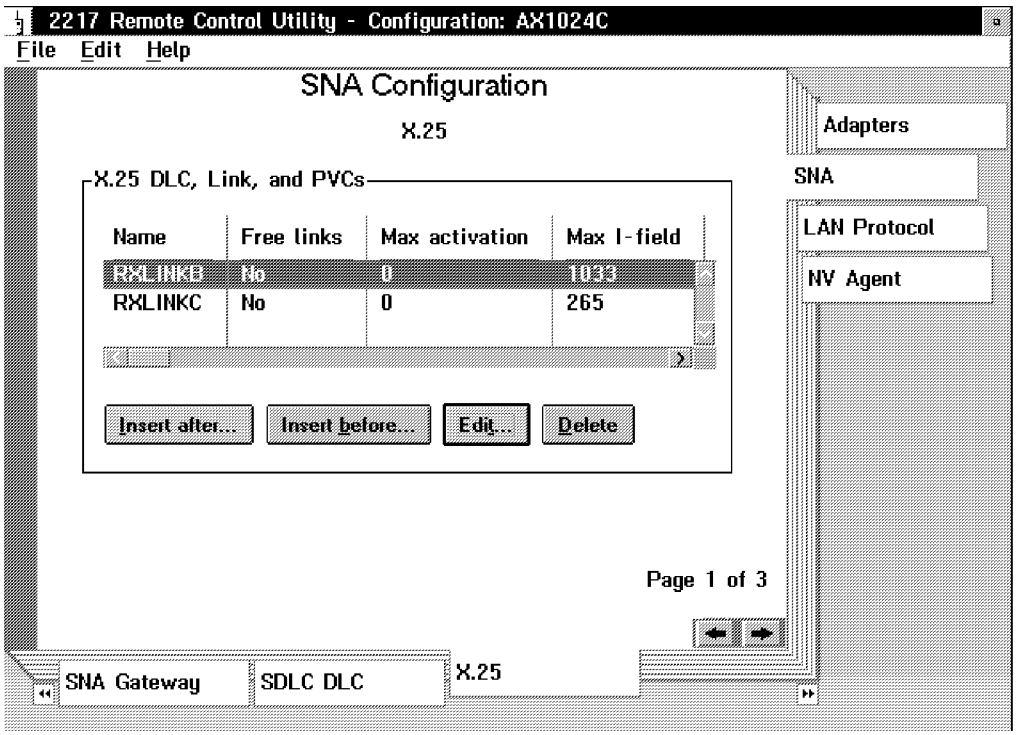


Figure 163. SNA Configuration - X.25 (Page 1 of 3)

We tried to let you re-create this configuration as simply as possible by including figures of each configuration panel, showing the values that we used in our working configuration. We comment on each entry field next to the figure in which it is displayed.

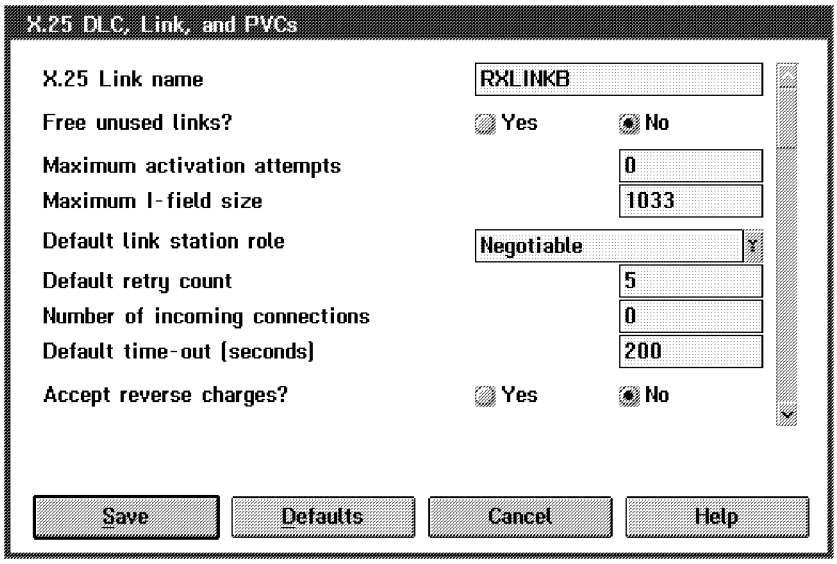


Figure 164. Edit X.25 DLC, Link, and PVCs - Part 1

- **X.25 Link name:** Enter a name for this link profile. Use a meaningful name, if possible (maximum of eight characters).
- **Free unused links?:** As explained before, depending on the overall structure of your network, you may want to take down unused, but costly connections. If so, select **Yes** here. In our case, we did not want the links to be taken

down, as we were using a modem eliminator connection only, so we selected **No** here.

- **Maximum activation attempts:** Specify the number of times the 2217 is supposed to attempt to bring up the X.25 connection at startup time (that is, how often the 2217 will try to get into Connect or Autoconnect state, depending on what you configure as the initial link mode, see Figure 165). The default is Zero (0), which means the 2217 will try until the desired state is reached.
- **Maximum I-field size:** See Configuring SNA Links for SDLC in Figure 154 on page 198. To avoid fragmentation, make sure this value is set to the largest expected RU size (as configured for the LU 6.2 modes) plus 9 bytes.
- **Default link station role:** We have left this field set to Negotiable whenever we connected two or more 2217s.
- **Default retry count:** This is used to retry various QLLC commands when the 2217 receives an incoming call from another SNA X.25 DTE for which no entry in the Remote X.25 SVC or PVC Directory exists. Leave the default 5 here, unless your network supplier requires a different value.
- **Number of incoming connections:** This is to specify the number of SVCs or PVCs that you expressively want to reserve for incoming connections. Zero (0) means you may use any SVC or PVC for both incoming and outgoing connections (which is the default).
- **Default time-out (seconds):** This is the time span that the 2217 will wait for a response from QLLC. Leave it set to 200 seconds, unless you have a particular requirement for a shorter or longer time span.
- **Accept reverse charges?:** This enables you to be charged for the connection by the network supplier, although the connection has been initiated from the workstation on the opposite side of this link.

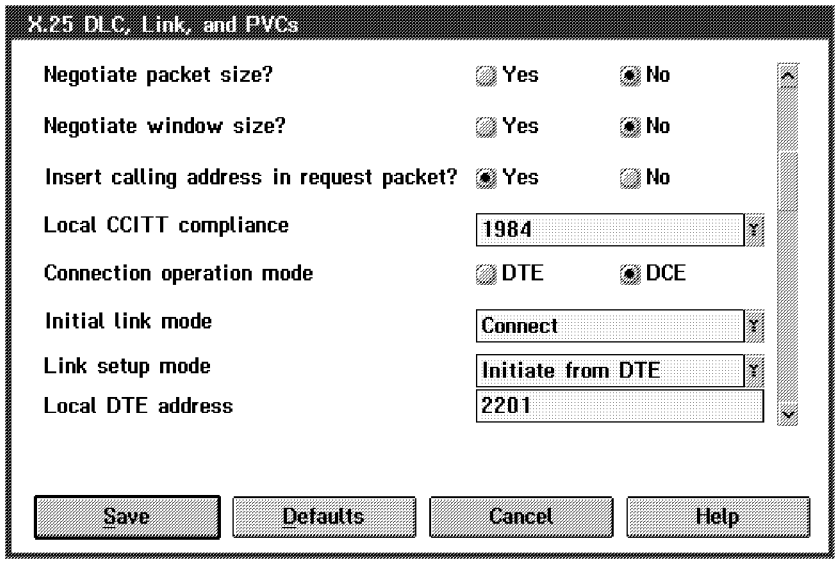


Figure 165. Edit X.25 DLC, Link, and PVCs - Part 2

- **Negotiate packet size?:** Because we will explicitly set the default packet size values, we do not want packet sizes to be negotiated. If you activated this option, the X.25 would attempt to set the packet sizes according to the maximum value specified. If you configure the maximum packet sizes equal

to the default packet sizes (as we did in this configuration example), you may neglect this option.

- **Negotiate window size?:** In a similar way, we configure the window size to use on both sides (send and receive). Therefore, we do not want it to be negotiated.
- **Insert calling address in request packet?:** When connecting two 2217s back to back over an X.25 link, make sure you have this option enabled. Otherwise, you will experience link setup problems (the call will be rejected and cleared). The 2217 expects the calling address to be part of the call request packet, no matter whether it has been inserted in the packet by the network's DCE(s) or by the DTE that issued the call request.
- **Local CCITT compliance:** Here you only select to which CCITT standard (1980, 1984 or 1988) your 2217s needs to comply. Information on the standard used in your X.25 network may be obtained from the network supplier.
- **Connection operation mode:** In most cases, you will attach the 2217 to X.25 networking devices that perform the role of a DCE. In this case, you will configure the 2217 as DTE here. In our particular example, as we were connecting two 2217s to each other without an intermediate X.25 network, one had to take the role of DCE.
- **Initial link mode:** Choose between Connect, Autoconnect and Disconnect. If you want an application to initiate the X.25 connection only, select **Autoconnect**. Otherwise, you will select **Connect** in most cases. This results in the 2217 trying to get into connect state at startup time.
- **Link setup mode:** Here you have to determine which device is responsible for the link initiation at the frame level. The choices are either Initiate from DTE or Initiate from DCE. Note that the link initiation on the physical level as well as the packet level may be different from this setting (for example, because the link station role on these levels may have been set to Negotiable).
- **Local DTE address:** Your network supplier will supply you with your local X.25 DTE address. This number, similar to a phone number, consists of 10 to 12 digits in real X.25 networks (usually). For the sake of simplicity, we decided to use four-digit addresses in our tests.

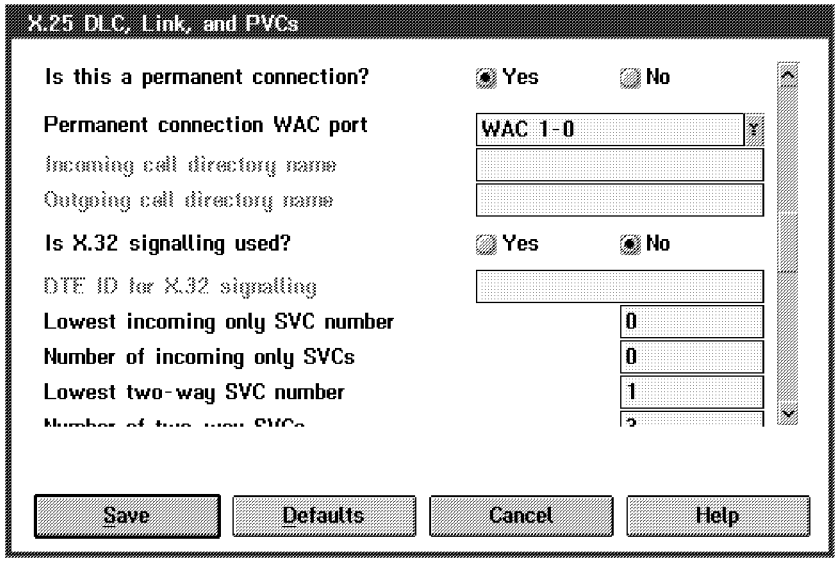


Figure 166. Edit X.25 DLC, Link, and PVCs - Part 3

- **Is this a permanent connection?:** Currently, there are at least three ways to establish the connection between the 2217 and the X.25 network's DCE:
  - Via a permanent connection, also called dedicated circuit
  - Via an X.32 dial-up connection
  - Via a V.25 bis dial-up connection

  If you specify a permanent connection, you will have to decide which WAC port will be used for this connection. If you specify that this is not a permanent connection, that is, a switched one, you will have to configure for incoming and outgoing call directory entries. Also, the RCU will not allow you to dedicate a particular WAC port to a switched connection. This is because all available WAC ports are pooled for switched connections by the 2217.
- **Permanent connection WAC port:** Specify the WAC port that is to be used for this connection.
- **Incoming call directory name:** If you specified permanent connection No, you need to configure the appropriate incoming call directory entries in the Switched profile and supply the names of the matching entries if required.
- **Outgoing call directory name:** If you specified permanent connection No, you need to configure the appropriate outgoing call directory entries in the Switched profile and supply the names of the matching entries.
- **Is X.32 signalling used?:** Consult your network supplier to find out whether the X.32 dial-up protocol is supported.
- **DTE ID for X.32 signalling:** When using X.32 signalling, additional options are available, such as the DTE ID. Refer to your network supplier for more information.
- **Lowest incoming only SVC number:** When configuring for X.25 Switched Virtual Circuits (SVCs), you may dedicate all or some of them for incoming or outgoing connections only, or you may specify all of the configured SVCs for both purposes. This entry field, in conjunction with the following ones, allows you to predetermine the number of SVCs that you want to dedicate to either incoming or outgoing traffic.

If you decide to do this, you also have to specify which of the available SVCs are meant for which purpose. You specify this by implicitly assigning a particular range of SVCs to incoming or outgoing while determining the lowest number of SVCs for this purpose.

For example, if you subscribed for ten SVCs on this link, and you wanted three of them to be used for incoming traffic only, you would set the entry field values like the following:

```
Lowest incoming only SVC number                    1
Number of incoming only SVCs                       3
Lowest two-way SVC number                          4
Number of two-way SVCs                             6
Lowest outgoing only SVC number                    0
Number of outgoing only SVCs                       0
```

You will always have to dedicate the SVC(s) for incoming connections first, then the two-way SVC(s), then the outgoing SVC(s).

In our case, we configured for three SVCs only (the maximum value being 128 SVCs per link), and we wanted them to be able to handle incoming as well as outgoing traffic. Thus, we used the settings shown in Figure 166 on page 211 and Figure 167.

Note that for incoming connections, the X.25 network determines which SVC will be used, while the 2217 determines which SVC to use for a particular outgoing connection.

- **Number of incoming only SVCs:** See Lowest incoming only SVC number.
- **Lowest two-way SVC number:** See Lowest incoming only SVC number.

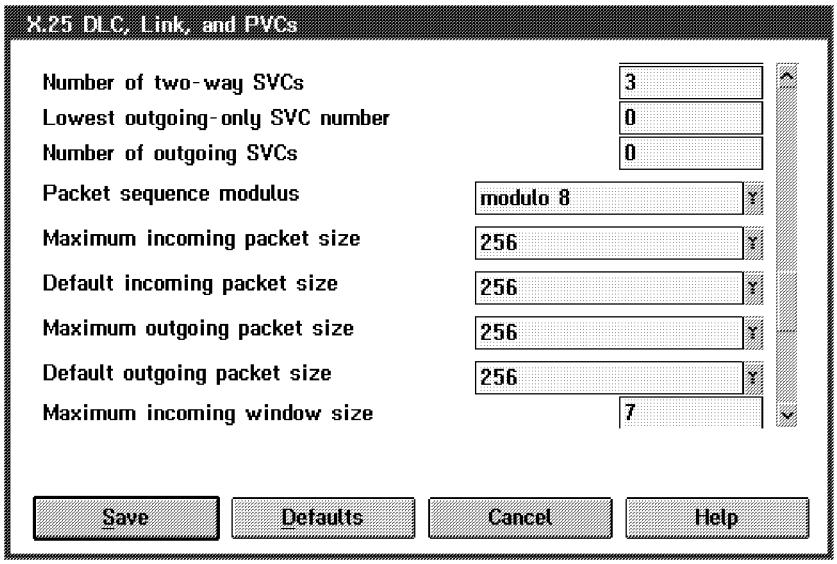


Figure 167. Edit X.25 DLC, Link, and PVCs - Part 4

- **Number of two-way SVCs:** See Lowest incoming only SVC number.
- **Lowest outgoing-only SVC number:** See Lowest incoming only SVC number.
- **Number of outgoing SVCs:** See Lowest incoming only SVC number.
- **Packet sequence modulus:** Select **Modulo 8** or **Modulo 128** depending on what algorithm your network supplier uses.

- **Maximum incoming packet size:** The packet size is the actual number of bytes of user data that are transported over the X.25 network as an entity. If an application data frame is larger than the number of bytes specified as the maximum packet size, the application data frame is segmented into smaller parts, the so-called *packets*. This value is usually determined with your subscription to the network and may depend upon the connection bandwith. Check your local options with your network supplier. Make sure that the value which you select here is not smaller than the maximum packet size as supported by your network supplier. Otherwise, your network performance may suffer unnecessarily.
- **Default incoming packet size:** This value may differ from the maximum packet size (that is, it may be smaller). In this case, you could allow the X.25 DLC to negotiate the packet size.
- **Maximum outgoing packet size:** See Maximum incoming packet size. The same applies here.
- **Default outgoing packet size:** See Default incoming packet size.
- **Maximum incoming window size:** This parameter is part of the transmission control at the X.25 DLC level. It is set to 7 by default, which is a good recommendation based on our experience.

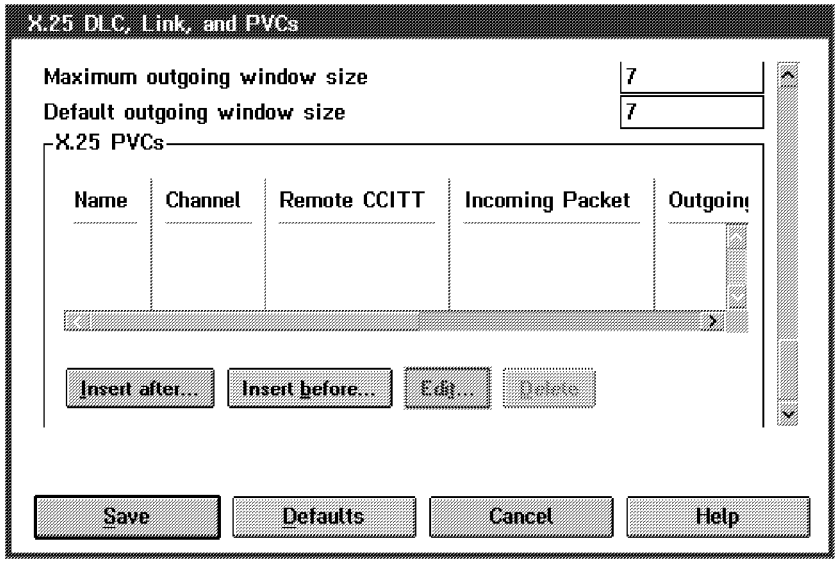


Figure 168. Edit X.25 DLC, Link, and PVCs - Part 5

- **Default incoming window size:** This value is set to 2 by default. You might want to increase it to a value between 4 and 7 for performance reasons.
- **Maximum outgoing window size:** See Maximum incoming window size.
- **Default outgoing window size:** See Default incoming window size.

X.25 Permanent Virtual Circuits (PVCs): Next, the X.25 PVCs overview is included in this configuration panel. To configure a PVC, click on **Insert after**, **Insert before** or **Edit** below the overview list. The parameters related to PVCs are explained with Figure 169 on page 214, which is the PVC detail view.

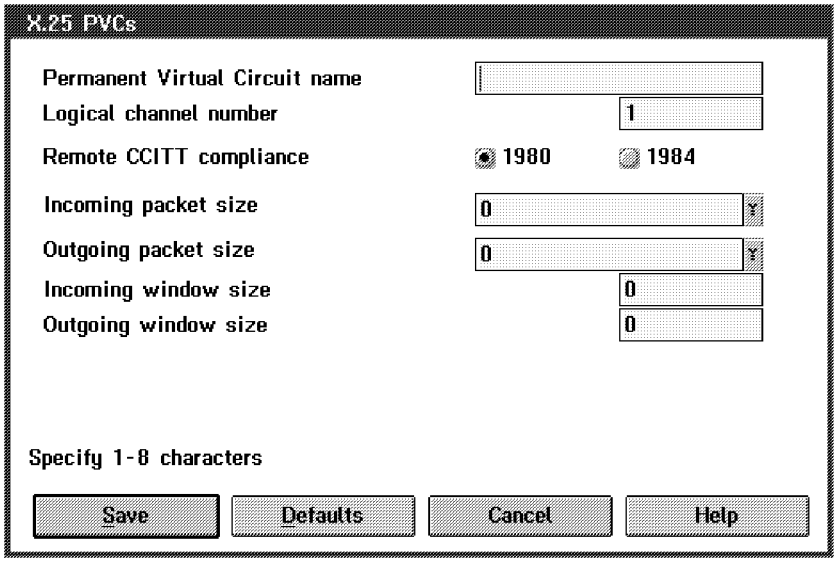


Figure 169. X.25 PVCs - Entry Fields Detail View

- **Permanent Virtual Circuit name:** If you configure for X.25 PVCs instead of SVCs, you have to supply a name per PVC. This is because X.25 PVCs are identified by names instead of numbers.
- **Logical channel number:** Choose one logical channel to match this PVC.
- **Remote CCITT compliance:** As you had to specify the CCITT standard to which this 2217 complies (that is, locally), you need to specify the version of the CCITT recommendation with which your partner X.25 system complies. CCITT 1984 includes enhancements over CCITT 1980. Therefore, it is important to select the correct standard.
- **Incoming packet size:** As applies for SVCs, you have to define packet sizes for PVCs as well. The difference is that there is only one packet size defined for PVCs for each direction (instead of a maximum and a default value).
- **Outgoing packet size:** See the above field.
- **Incoming window size:** As for SVCs, you may specify a value here to be used for link level transmission control. The value determines the number of packets that may be received before an acknowledgment is sent. The range is 0-127; we recommend a minimum value of 7.
- **Outgoing window size:** See the above field.

9.2.3 Configuring the Remote X.25 PVC Directory

The Remote X.25 PVC Directory contains information that is used to establish the connection on the packet level (that is, to determine which station issues the call and which PVC is used for the call).

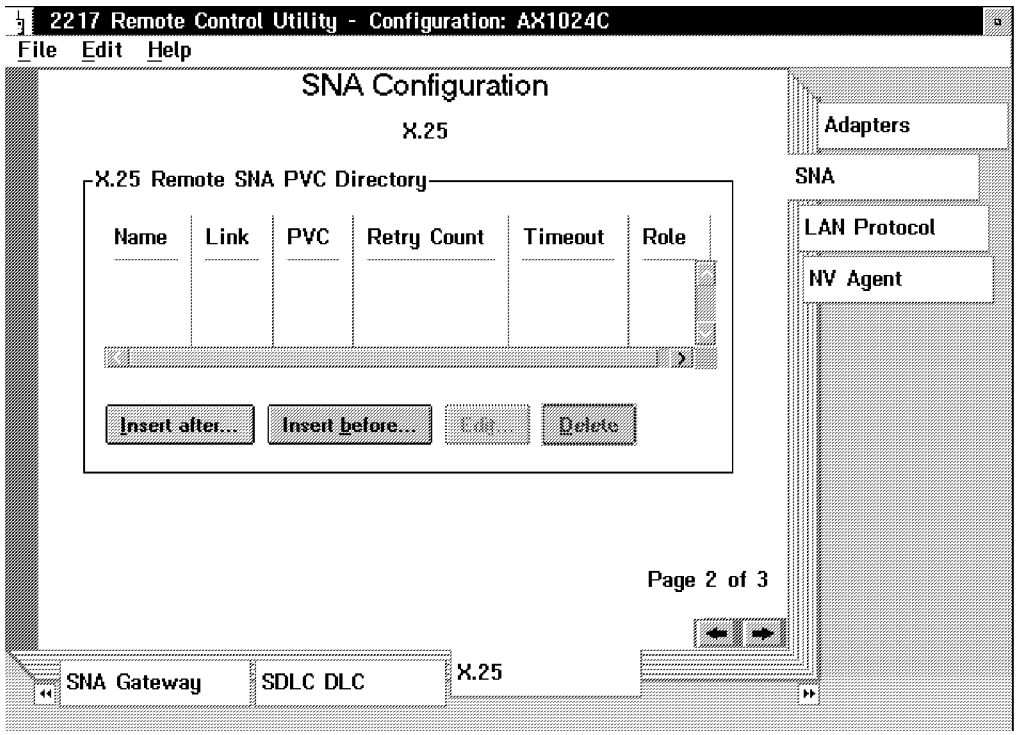


Figure 170. SNA Configuration for X.25 (Page 2 of 3) - X.25 Remote SNA PVC Directory Overview

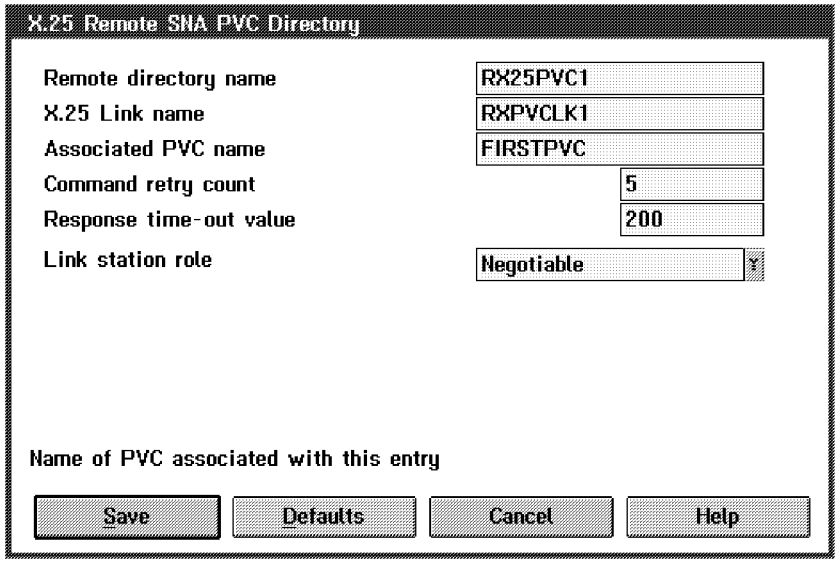


Figure 171. Edit X.25 Remote SNA PVC Directory Entry - Detail View

The idea about this Remote SNA PVC Directory is that it is used to concatenate the X.25 link information (describing this 2217s role and characteristics in the X.25 connection) to the PVC that is going to be used for the connection and which describes the partner's characteristics (from this 2217s perspective).

- **Remote directory name:** Specify a name for the particular entry here.
- **Associated PVC name:** Enter the name of the PVC (as configured before) that points to the partner X.25 workstation.

- **Command retry count:** This is used for various QLLC commands upon call reception. If not specified there, the value as specified in the X.25 DLC is taken instead.
- **Response time-out value:** Leave the default, unless some other value is required by the network supplier.
- **Link station role:** When connecting 2217s to each other, leave the default Negotiable.

9.2.4 Configuring the Remote X.25 SVC Directory

This information is used to establish the connection on the packet level. Therefore, it has to include the role of this 2217 during link establishment (which station will issue the call, here set to Negotiable) as well as the destination's DTE number and a reference to the X.25 DLC. Figure 173 on page 217 and Figure 174 on page 218 give examples.

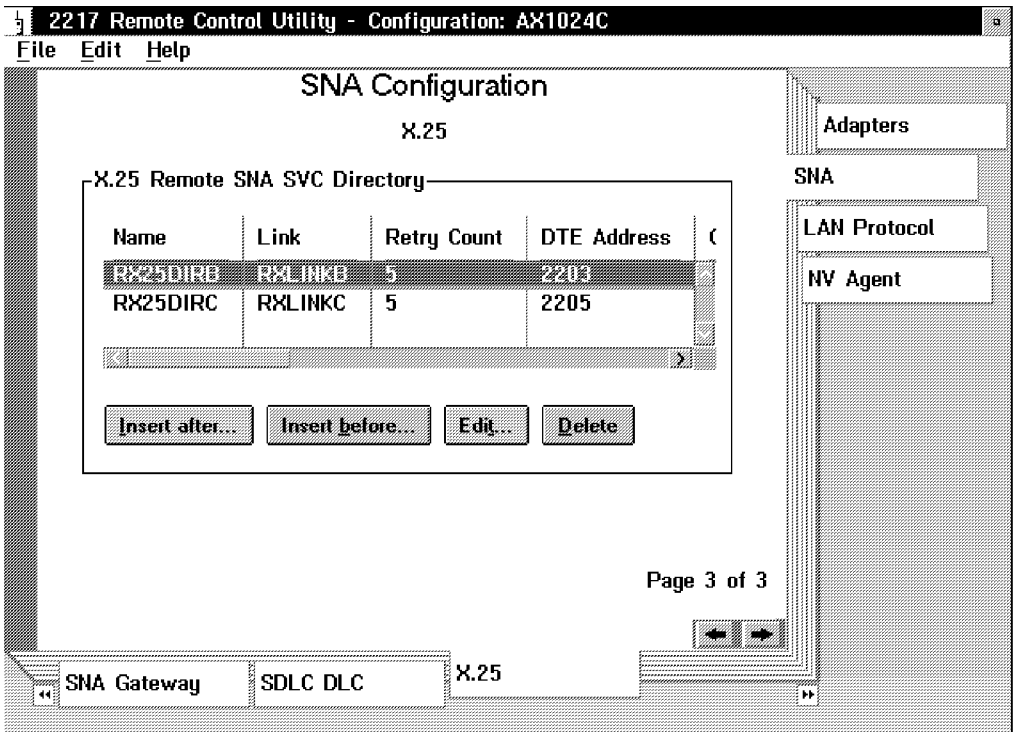


Figure 172. SNA Configuration for X.25 (Page 3 of 3) - X.25 Remote SNA SVC Directory Overview

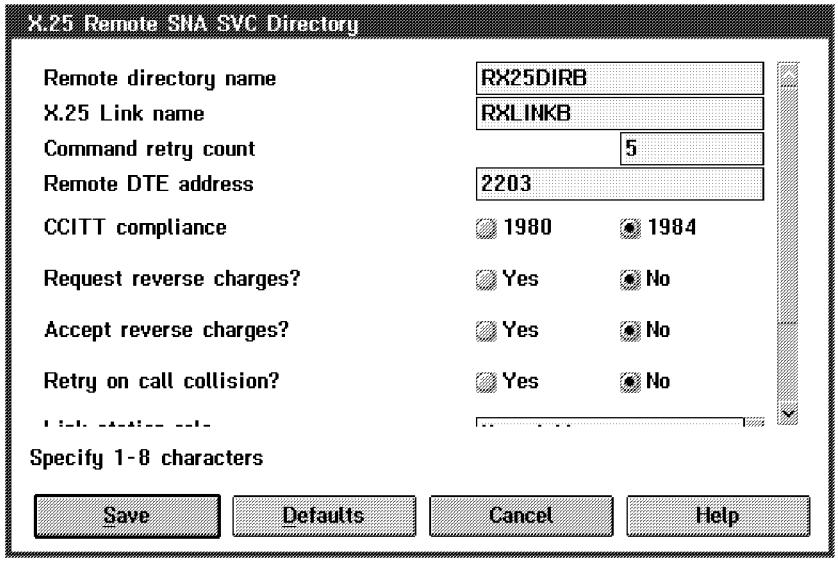


Figure 173. Edit X.25 Remote SNA SVC Directory Entry - Part 1

- **Remote directory name:** Specify the name for this entry here.
- **X.25 Link name:** Enter the name of the X.25 link (as already configured) that you want to use with this Remote SVC entry.
- **Command retry count:** This is used for various QLLC commands upon call reception. If not specified there, the value as specified in the X.25 DLC is taken instead.
- **Remote DTE address:** Specify the partner's X.25 DTE address here. It is a 10 to 12 digit number (usually) and will be supplied by your network supplier.
- **CCITT compliance:** Select the appropriate value (1980 or 1984), depending on how your partner station has been set up.
- **Request reverse charges?:** In a switched connection scenario, you can request the network supplier to charge the partner X.25 workstation's account for the link usage rather than your account. Select **Yes** here if you want to do so and the X.25 that you are on supports this feature.
- **Accept reverse charges?:** If you agree to be charged for link usage initiated by a partner system, select **Yes** here. Unfortunately, it is not possible to limit this potential acceptance to certain partners.
- **Retry on call collision?:** You should set this parameter to Yes when you want the 2217 to retry the connection by itself (in the case of a call collision), instead of waiting for the other workstation to retry the connection.

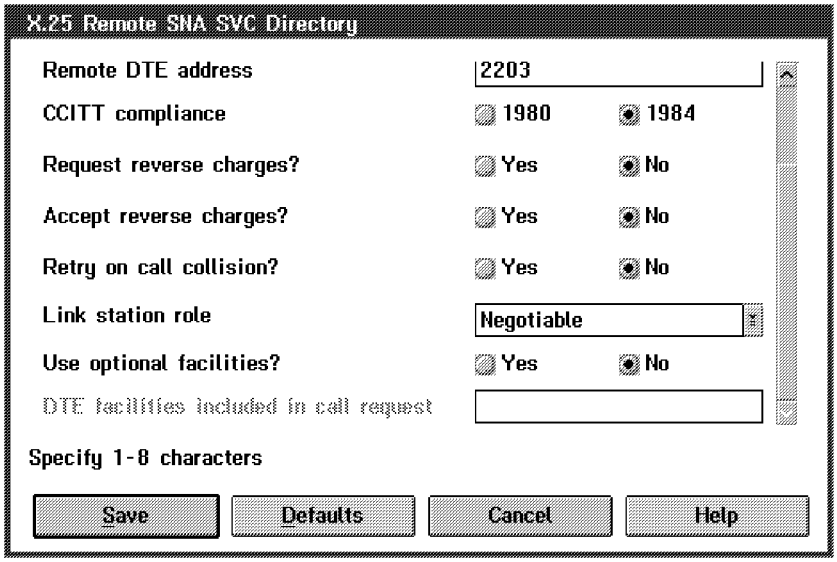


Figure 174. Edit X.25 Remote SNA SVC Directory Entry - Part 2

- **Link station role:** Leave this set to Negotiable, when connecting 2217s to each other.
- **Use optional facilities:** If you need to use additional X.25 facilities other than Accept Reverse Charges, for example, you will have to select **Yes**.
- **DTE facilities included in call request:** Certain options may be entered in hex format here. For more information, contact your network supplier or refer to the CCITT X.25 recommendation.

9.2.5 Troubleshooting X.25 Configuration Problems

In case you experience link establishment problems, you might want to take a trace on the 2217 to be able to determine which steps have been processed and which were the results. To be able to do this, the tracing subsection in the Diagnostics section of the Operations and Administration of Remote 2217 MpC offers the start and stop functions for these. Figure 175 on page 219 gives an example of this panel.

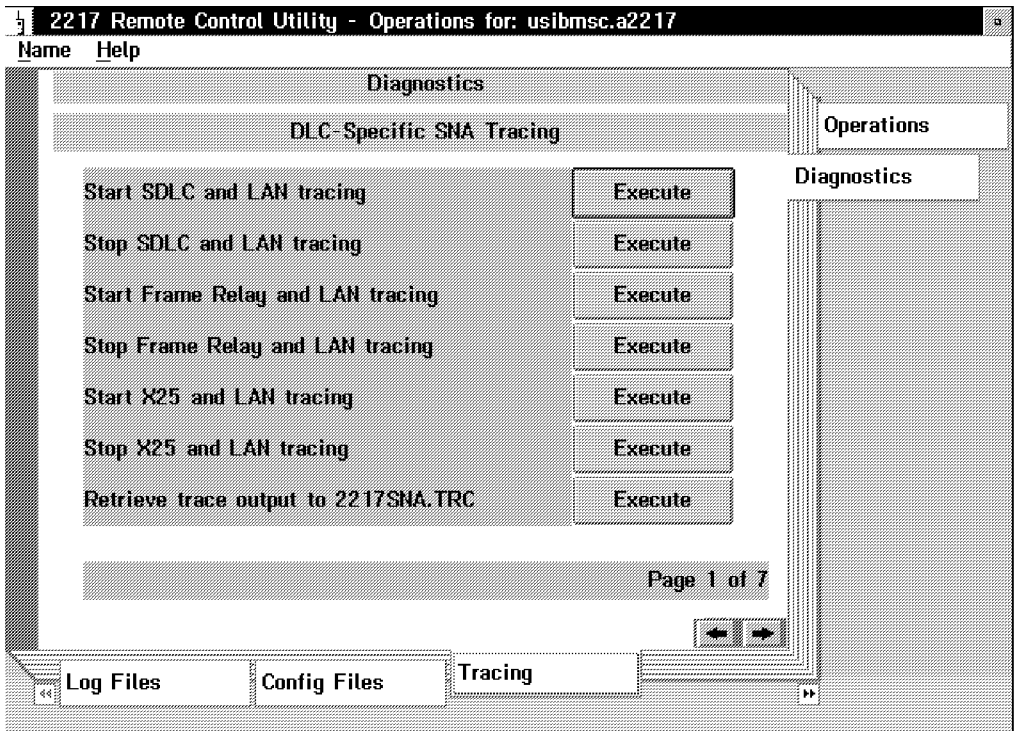


Figure 175. Diagnostics - DLC-specific SNA Tracing

Chapter 10. Frame Relay and Source Route Bridging

The IBM 2217 MpC supports source route bridging (SRB) over frame relay and token-ring LANs. When using this function, you can bridge LAN protocols such as DECnet and AppleTalk. Routed protocols such as SNA, IP, IPX and NetBIOS are disabled by default, but you can also enable SRB for these protocols. In this chapter, we show a configuration in order to bridge two physical LANs.

10.1 What Is Source Route Bridging

The IBM 2217 MpC uses source route bridging with bridge filters to limit the traffic in either or both directions from the LAN to the WAN and allows the 2217 to support protocols such as DECnet and AppleTALK. The bridge filter lets you specify precisely the kinds of frames that can cross the bridge, by using such attributes as frame type, hop counts, source and destination addresses and data within the frames themselves.

There are many reasons why you might want to filter bridge traffic. For example:

- Token-ring LAN speeds are much faster than typical WAN link speeds. High volume LAN traffic trying to cross a bridge into the WAN can cause some undesirable results, such as overflowing buffers, timeouts and lost connections.
- Depending on how you are billed for your WAN traffic, unnecessary traffic that gets onto the WAN can cost you money. Therefore, it makes sense to limit the traffic that gets across the bridge from the LAN to the WAN.
- You might want to insulate your LANs from WAN traffic coming across the bridge.
- If your bridge connects two LANs, you might want to reduce the traffic flowing between them.
- There are times when you want to restrict the traffic of unknown users from your LANs and WANs to enhance security.
- When you have configured both a source route bridge and multiprotocol routing in the 2217, you may want to install bridge filters to prevent the same data from being both bridged and routed.

10.2 How the 2217 Bridges Multiprotocol Data

The 2217 supports source route bridging over frame relay and token-ring LANs. Source route bridging can be used:

- Over the 2217 token-ring LAN adapter port.
- Over the 2217 WAC ports when configured for the frame relay protocol. This includes bridging between two WAC ports.

Therefore, up to five ports can be used for bridging in the 2217, depending on the 2217's adapter configuration. For more information on the 2217 adapters, see Chapter 4, "Configuring LAN and WAC Adapters with the 2217 Remote Control Utility (RCU)" on page 4-1 of the *2217 User's Guide*.

In source route bridging, end stations find their communication partners by sending discovery frames (broadcasts). These frames are forwarded by the bridge. Each frame, forwarded on the way to the destination, has the bridge's address inserted into a route information field in the frame header. This information is used by the end station to communicate back to its partner because each data frame sent contains the bridge addresses through which the frame must pass back.

A 2217 that is bridging traffic can operate with other types of bridges, such as:

- Workstations running the Token Ring Bridge/DOS Program for frame relay
- Workstations running RouteXpander/2
- 6611 network processors

When configured for source route bridging and using the supplied filter, the 2217 routes traffic for the protocols it supports (SNA, TCP/IP, IPX and NetBIOS) and bridges traffic for the protocols it does not support. The 2217 uses the dedicated routing services of the protocols, expanding their routing areas to include an entire WAN.

10.3 Scenario Description

The same frame relay configuration used in the IPX over SNA scenario is used in the SRB over frame relay scenario. In this case, you would need to enable source route bridging in the token-ring and frame relay protocols. For more information please review Chapter 7, “IPX Applications Over SNA” on page 169.

This configuration allows IPX data to be routed through two 2217s, connected by frame relay. There is a LAN connected to each of the IBM 2217 MpCs. The IPX data is sent from a client workstation on the local LAN to a Novell server on the remote LAN.

As described before, point-to-point frame relay connections are used between the three IBM 2217 MpCs and the frame relay segment number is 151.

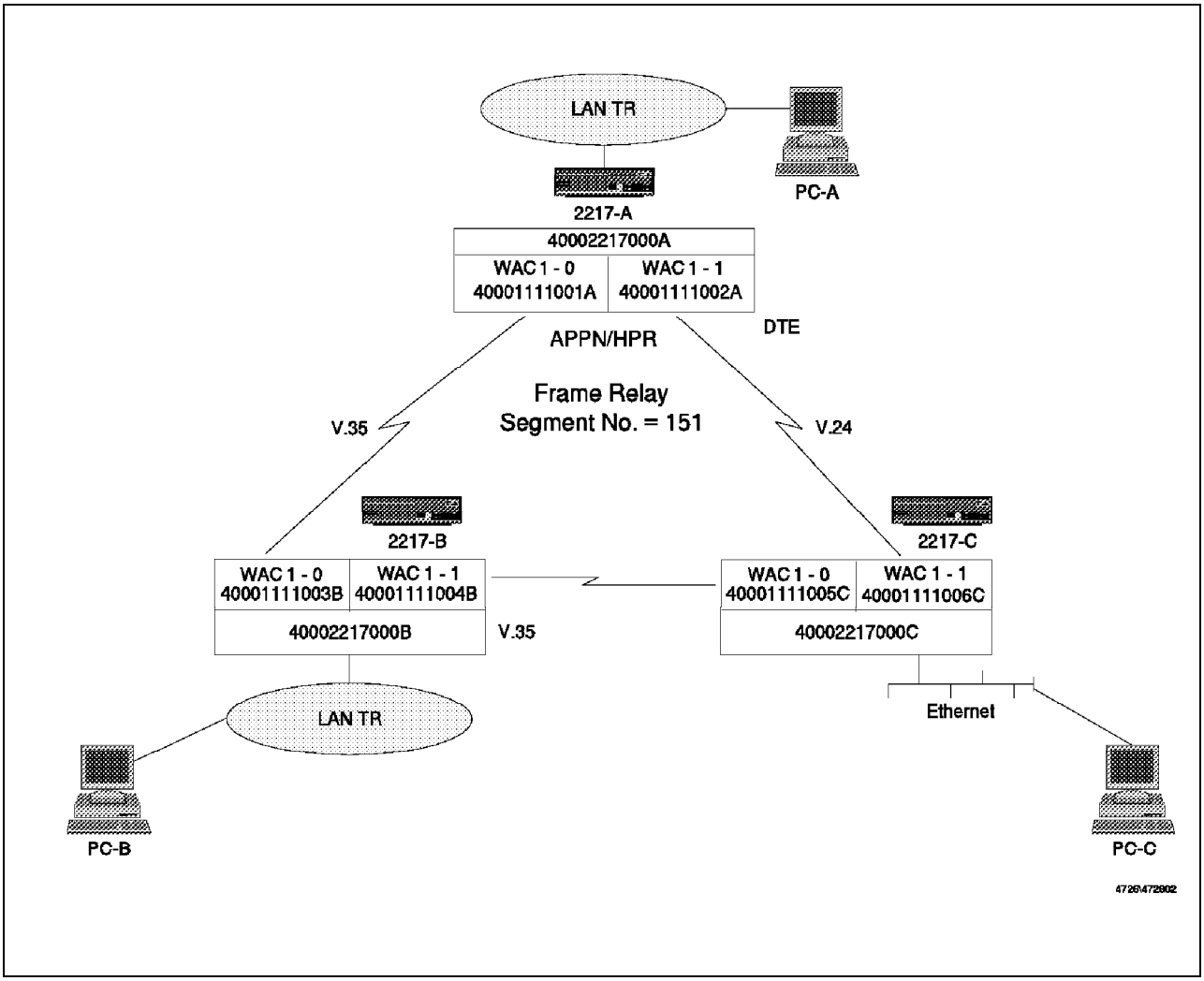


Figure 176. Frame Relay Scenario

The network consisted of:

- Two model 200 2217s, each with a WAC and token-ring adapter.
- A 512 kbps WAN frame relay connection between the 2217s using a V.35 modem eliminator.
- The remote LAN had an IPX sever attached and was a production LAN that connected to the entire department.
- The local LAN, which was an 8228, had a 6586 attached running OS/2 Warp and Novell client software.
- The sample filter program provided in the 2217 RCU was edited to allow IPX data to be bridged instead of routed by the 2217.
- The 2217s were running Release 2 with APARs MX00201A, MX00201B, MX00201C, MX00201D, MX00201E, IR32755 and IR32822 applied.

10.4 LAN Adapter Configuration for Source Route Bridging

When you configure the LAN adapter, you enable SRB for the token-ring LAN in the IBM 2217 MpC. When you enable SRB, the following configuration options are enabled:

- Port Specific SRB Parameters
- Global SRB Parameters

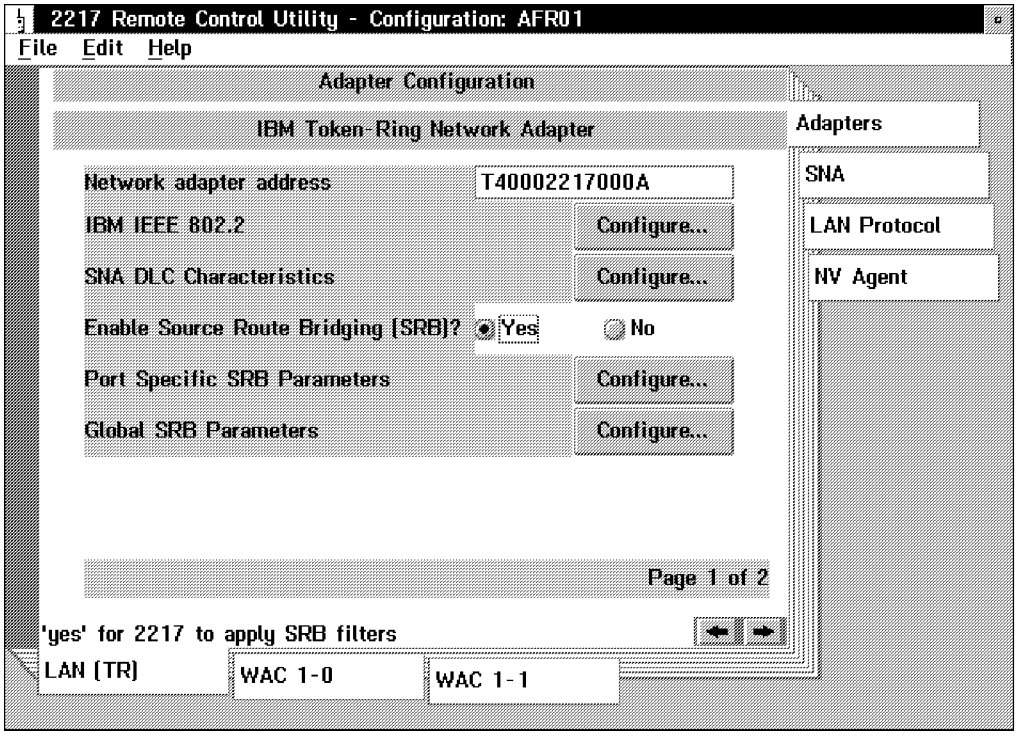


Figure 177. Token-Ring Adapter Configuration - Enable Source Route Bridging (SRB)

- **Network Adapter Address:** This field specifies the network address of the adapter card. It must be a locally administered address, and it must be unique among all other network adapter addresses on the network.
- **IBM IEEE 802.2:** This takes you to the IEEE 802.2 configuration panel. Unless it is required, you will normally use default values.
- **SNA DLC Characteristics:** This takes you to the DLC profile configuration panel. In this configuration, default values are used.
- **Enable Source Route Bridging (SRB):** This radio button specifies whether source route bridging should be enabled on this port. Select **Yes** to enable source route bridging.

  Notes:

  1. Simply disabling the routing of the protocols does not cause the protocol to be automatically bridged.
  2. Select **Yes** if you want the IBM 2217 MpC to apply the filters defined in the GSDSRB.INI file.
  3. The default filter file (supplied with the 2217) prevents bridging of IPX, NetBIOS, IP and SNA protocols since these are normally routed by the 2217. If you need to bridge any of those protocols or if you wish to apply

other types of bridge filters, you must modify the filter file and download it using the RCU.

- **Port Specific SRB Parameters:** This option takes you to the port specific SRB parameters configuration screen which is explained later.
- **Global SRB Parameters:** This option takes you to the global SRB parameters configuration screen which is explained later.

10.4.1 Port Specific SRB Parameters (Token Ring)

In this panel, you enter port specific SRB parameters. Most of the default values in this panel are normally valid for the majority of configurations. However, you must specify the proper ring number for the LAN.

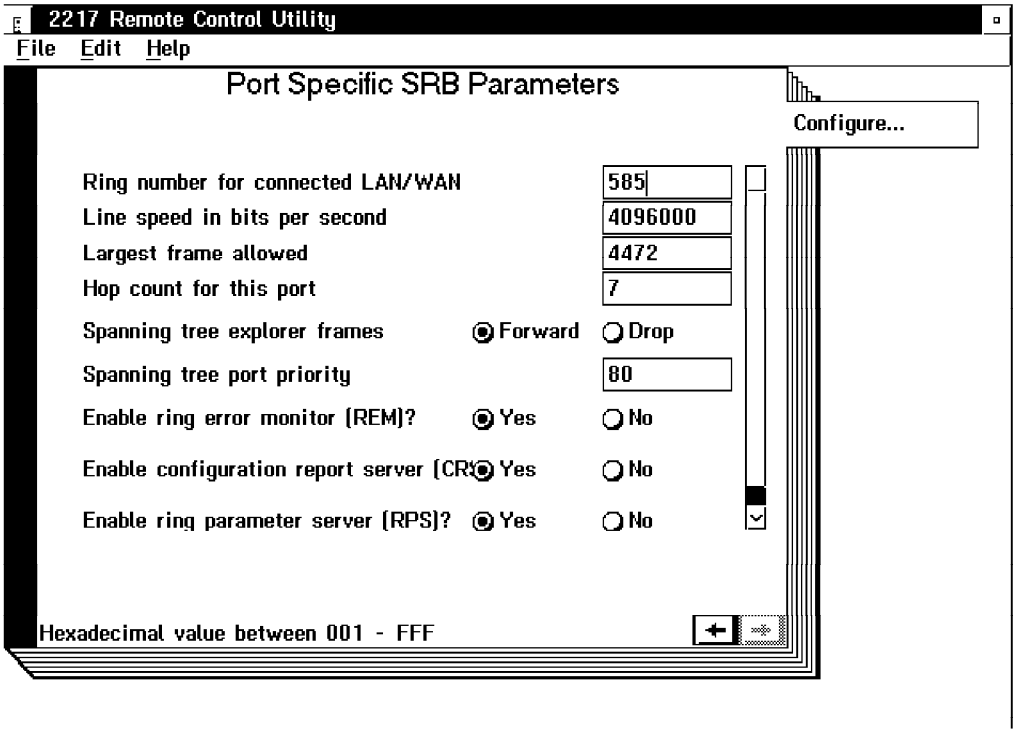


Figure 178. Token-Ring Adapter Configuration - Port Specific SRB Parameters

- **Ring number for connected LAN/WAN:** This field specifies the ring number for the LAN or WAN segment to be bridged. It uniquely defines the segment. It is a value from 001 to FFF (hexadecimal).
  - For the token-ring (LAN) side, it must match the ring number for the LAN segment to which the adapter is attached.
  - For the frame-relay (WAN) side, it must match other frame-relay bridges in the network.

  Note: In this configuration, we use 585 for the token-ring number because there were other bridges on the LAN that this 2217 was attached to. Check with your LAN coordinator about the ring number you should use for the LAN.

Hint

If you do not know or are not sure of the token-ring number you should use, you may want to display the LANTRAN.LOG file using the RCU. This will tell you if you are using the actual value or not.

- **Line speed in bits per second:** This field specifies the speed, in bits per second (bps), of the attached local area network (LAN) or wide area network (WAN). This value is used to calculate the relative path cost value for the LAN or link. The relative path cost is used by the spanning tree protocol to establish the most efficient path to other root nodes of the bridged network. Higher line speeds produce lower relative path costs.
- **Largest frame allowed:** This field specifies the size (in bytes) of the largest source-routed frame that can be sent or received through this bridge port. It must be smaller than the maximum size data unit (MSDU) for the associated medium access control (MAC). The MSDU value is specified in:
  - Maximum Size of a Transmitted Packet (frame relay).
  - Transmit Buffer Size (LAN). The bridge will round this value down to one of the following sizes: 516, 1500, 2052, 4472, 8144, 11407, or 17800.
- **Hop count for this port:** This field specifies the maximum number of bridges an explorer (broadcast) frame can cross in this bridged LAN before it is discarded. If the number of bridges an explorer frame has traversed before reaching this bridge is greater than or equal to this value, the frame is not forwarded.

  Most LANs have a limit of 7 hops, although special-purpose LANs may allow up to 13 hops. (The value is generally the same for all bridge ports in the LAN.)
- **Spanning Tree explorer frames:** This radio button specifies how spanning tree explorer frames (single-route broadcast frames) received on this bridge port are processed if Enable Spanning Tree Operation (on the Global Source Route Bridging Parameters configuration notebook panel) is disabled:
  - Forward to forward the frames (default)
  - Drop to discard the frames
- **Spanning tree port priority:** This field specifies the priority used by the spanning tree protocol to break the ties between ports to determine the Designated Port for the bridge (the default is 80).

  Notes:

  1. The default is valid for most configurations.
  2. The lower the value, the higher the priority of the port.
  3. This value is not used directly by the spanning tree protocol; it is used to calculate a ranking of ports in priority from 0 to 15. The resulting port ranking is used as the Port Priority in the bridge path data unit (BPDU) frames sent to other bridges.
- **Enable ring error monitor (REM):** This radio button specifies whether the Ring Error Monitor (REM) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the REM functional address to monitor beacon and soft error conditions on this LAN segment (default)

- No to disable the REM functional address

- **Enable configuration report server (CRS):** This radio button specifies whether the Configuration Report Server (CRS) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the CRS functional address to monitor configuration changes on this LAN segment (default)
  - No to disable the CRS functional address
- **Enable ring parameter server (RPS):** This radio button specifies whether the Ring Parameter Server (RPS) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the RPS functional address to allow the 2217 to send initialization information to new stations attaching to this segment (default)
  - No to disable the RPS functional address

10.4.2 Global SRB Parameters (Token Ring)

In this panel, you configure the global SRB parameters. Most of the default values in this panel are normally valid for the majority of configurations. However, you must specify the proper phantom ring number when configuring multiple ports.

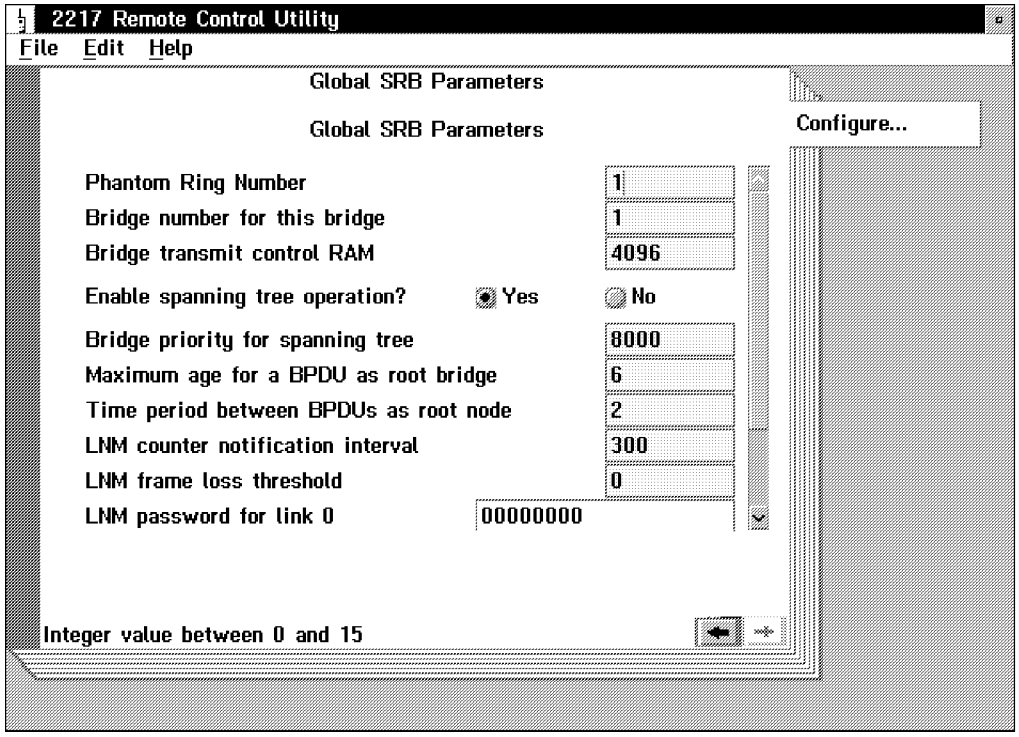


Figure 179. Token Ring Network Adapter - Global SRB Parameters

- **Phantom Ring Number:** This field specifies a unique virtual ring number used by the bridge to allow frames to be forwarded to and from LAN adapters that do not support multiple target rings (such as the IBM 16/4 Shared RAM Token-Ring Adapter). The default value is 1.

  The field is required when three or more ports are configured for bridging. it is ignored if there are only two ports configured for bridging.

Note

In this configuration, we discovered that the IBM 2217 MpC compares this value to other ring numbers when loading to the 2217 or when running the verification test. Even if you only have 2 ports configured, the IBM 2217 MpC will log an error in the LANTRAN.LOG; if this number is a duplicate, and the configuration will fail. This number *must* be unique.

- **Bridge number for this ring:** This field ensures a unique path when multiple bridges are used in parallel between two or more of the defined rings. The default value is 1.

  Note

  Change the default value only if there is another bridge on the same ring segment, both bridges are connected in parallel to another ring, and the other bridge is assigned the default.

- **Bridge transmit control RAM:** This field specifies the number of bytes of shared RAM allocated for forwarding bridge frames. The default value is 4096.
- **Enable spanning tree operation:** This radio button specifies whether the bridge participates in the IEEE 802.1D spanning tree protocol:
  - Yes if the bridge participates in the IEEE 802.1D spanning tree protocol (default)
  - No if the Spanning Tree Explorer Frames determines how the spanning tree explorer frames for each port are handled
- **Bridge priority for spanning tree operation:** This field specifies the priority of this bridge. It is used in the spanning tree algorithm to influence the root node selection. The default value is 8000.

  Bridges with lower priority values become root nodes in preference to bridges with higher priority values.
- **Maximum age for a BPDU as root bridge:** This field specifies the number of seconds a bridge path data unit (BPDU) may exist before it is discarded when the bridge is acting as the root node of the spanning tree. The default value is 6.
- **Time period between BPDUs as root node:** This field specifies the number of seconds between bridge path data units (BPDUs) when this bridge is the root node or in contention to be the root node. The default value is 2.
- **LNM counter notification interval:** This field specifies the frequency (in seconds) at which the LAN bridge server sends bridge counter report frames to the LAN Network Manager. It is only used when the 2217 source route bridge is enabled. The default value is 300.

  Notes:

  1. This value may be changed by a controlling LAN Network Manager.
  2. The default indicates that the LAN bridge server sends the counters every 5 minutes.
  3. A value of 0 indicates that the LAN bridge server does not send bridge counter report frames periodically.

- **LNM frame loss threshold:** This field specifies a threshold value for the maximum frame loss rate that the bridge can sustain. It is specified as the number of frames lost per 10,000 frames. The default value is 0.

  When this threshold is exceeded, a notification is sent to any LAN Network Manager that has requested the report and an indication is set in the 2217's source route bridge log.

  Notes:

  1. This value may be changed by a controlling LAN Network Manager.
  2. The default indicates that no threshold calculation is made.

- **LNM password for link 0:** This field specifies the password for the LAN Network Manager (LNM). The following restrictions apply. The default value is 00000000.

  - The password can contain any alphanumeric characters (A-Z, 0-9), or any of the special characters @, #, $, or %.
  - Trailing blanks are allowed.
  - Alphabetic characters are processed as uppercase characters.

  The password is only used if the 2217's source route bridge is enabled and may be changed by a controlling LAN Network Manager.

  Note: Link 0 is the controlling link; all other links are observing links.

10.5 WAC Adapter Configuration for Frame Relay

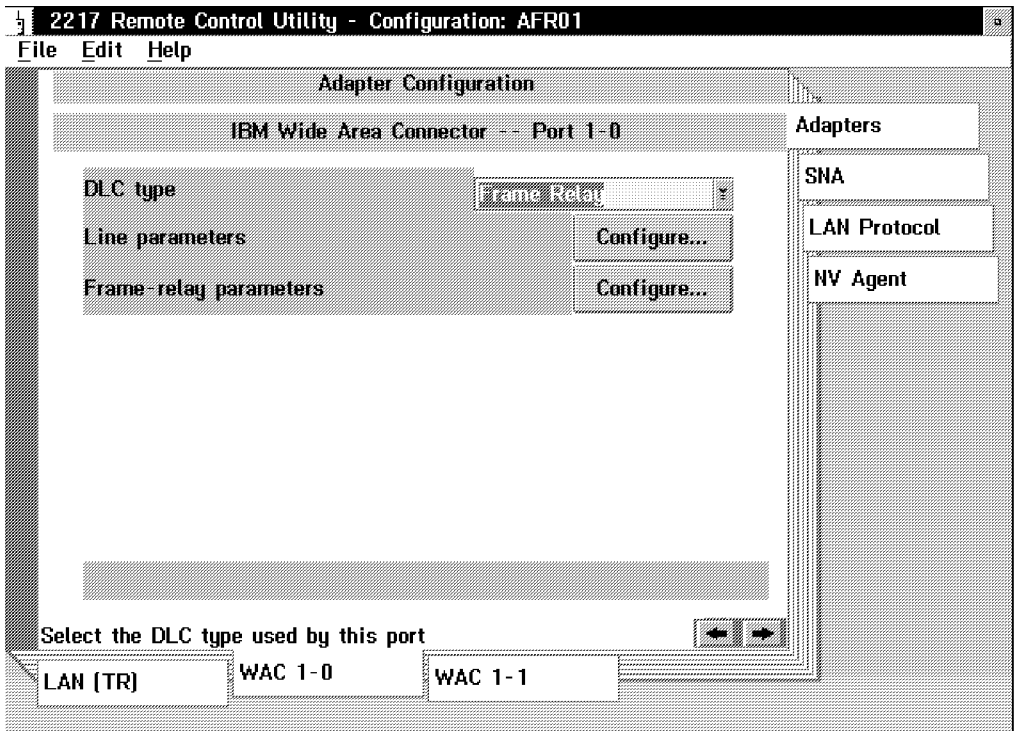


Figure 180. Adapter Configuration - IBM Wide Area Connector -- Port 1-0

- **DLC type:** This field specifies the type of data link control (DLC) used by this port. It should be Frame Relay.

- **Line Parameters:** This option allows you to configure the line parameters, which are discussed in 10.5.1, “Line Parameters” on page 230.
- **Frame-relay parameters:** This option allows you to configure the frame relay parameters, which are discussed in detail in 10.5.2, “Frame Relay Parameter Configuration” on page 232.

10.5.1 Line Parameters

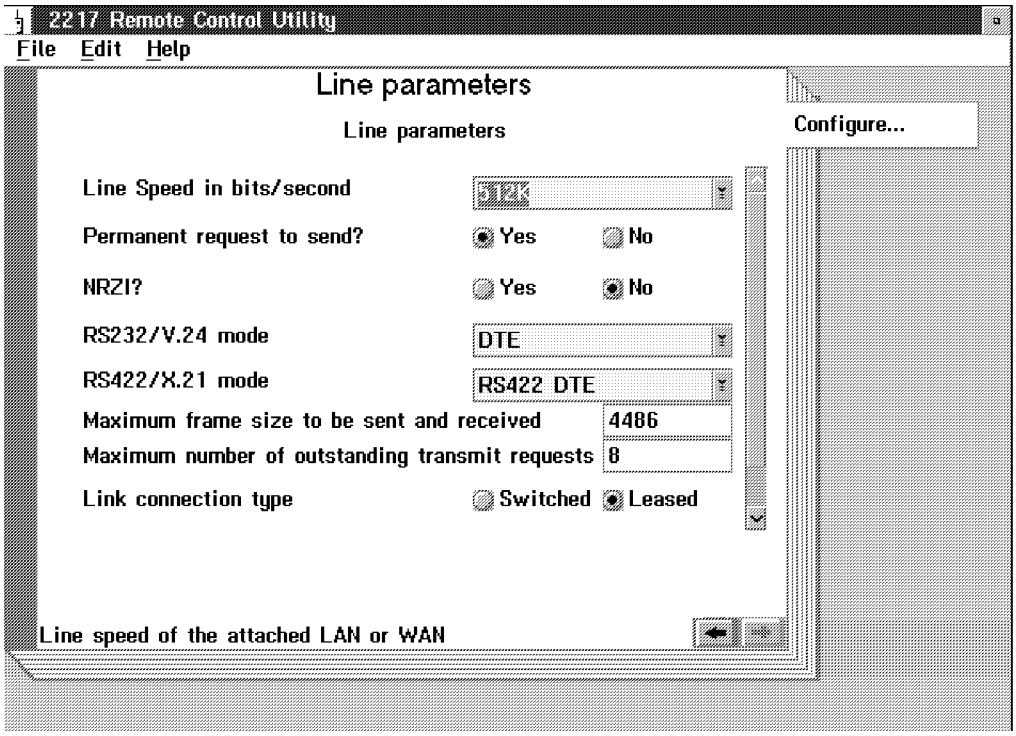


Figure 181. WAC Adapter Parameters - Line Parameters

- **Line speed in bits/second:** This field specifies the clock speed used when the port generates the clocking signal.

  When in normal DTE mode, the clocking is generated by the modem or DSU/CSU, and this parameter is ignored. The port generates clocking in all DCE modes and in the RS232/V.24 mode. The default is 19200 bps.

  Note

  Clock speeds of 2M, 1.5M, 1M, 768K, 512K, 256K and 64K are actually 1.843M, 1.474M, 983.040K, 776.084K, 508.468K, 254.234K and 63.833K, respectively.

- **Permanent request to send?** This radio button specifies whether half-duplex transmission facilities or full-duplex transmission facilities are used. The default is No.

Notes:

1. Specify Yes for constant Request to Send (RTS). Most modern communications facilities are full-duplex and require constant RTS for point-to-point lines and the primary end of SDLC lines.
2. Specify No for switched RTS (Line Turnaround Required) if either half-duplex communications facilities are being used or the line is the secondary end of a multidrop SDLC line.
3. You need to check with the provider of the frame relay network to determine if RTS needs to be on or off. Some frame relay network providers require that it be set to either on or off. In most cases it should be on.

- **NRZI:** This radio button specifies whether non-return-to-zero inverted (NRZI) encoding is used for synchronous connections. The default is No.

  Note

  The devices at each end of a physical connection must use the same encoding method. For example, if this port is connected on a leased line to an NCP, the encoding method is part of the NCP line definition. For X.25 and frame relay links, the encoding method should match what is being used by the network data circuit-terminating equipment (DCE).

- **RS232/V.24 mode:** This field specifies the clocking modes used if the RS232/V.24 card is installed:
  - DTE when connected to a modem that generates the clocking (default).
  - DTE pin24 TXC when connected to a modem that requires the DTE to generate Tx clock on pin 24.
  - DCE when the WAC provides both Rx and Tx clocks. DCE mode requires the use of a crossover adapter as described in the *2217 Planning Guide*.
- **RS422/X.21 mode:** This field specifies the clocking modes used if the RS422/X.21 card is installed:
  - RS422 DTE mode (default value). This mode requires the RS422 cable.
  - X.21 DCE TxC_Echo mode. The attached DTE must echo the clock back on line B to be used for clocking data into the Wide Area Connector. This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.
  - Normal X.21 DCE mode. This mode requires a Crossover Adapter as described in the *2217 Planning Guide*.
  - Normal X.21 DTE mode.
  - X.21 DTE TxC_Echo mode. The clock received on the S line is echoed on line B to eliminate Tx clocking skew on long cables.
- **Maximum frame size to be sent and received:**
  - 4486 for the frame relay network
  - 2080 for SDLC and X.25
  - DEFAULT for WAC (RCU selects 4486 or 2080, depending on the DLC Type specified)

  This field specifies the maximum size data frame that can be processed. It is used by the MAC driver to allocate buffers and must be set larger than any

expected data and header size used by the higher protocol. However, if it is set unnecessarily high, buffer space is wasted.

In particular, this value must be larger than the Maximum I-Field Size specified in the SNA DLC Characteristics panel for this port:

- For all interface types except X.25, a value 20 bytes larger than the Maximum I-Field Size is recommended.
- For X.25 interfaces, a value 10 bytes larger than the maximum packet size used on any virtual circuit is recommended.

- **Maximum number of outstanding transmit request:** This field specifies the number of outstanding transmit requests supported by the device driver for the line attached to the frame relay device driver. The default value is 8.
- **Link connection type:** This radio button specifies whether the connection on this port is switched or leased. It is used only for SDLC or X.25 connections; frame relay connections must be leased. The default is leased.

10.5.2 Frame Relay Parameter Configuration

In this panel, you enable the source route bridging (SRB) function in order to bridge token-ring LANs.

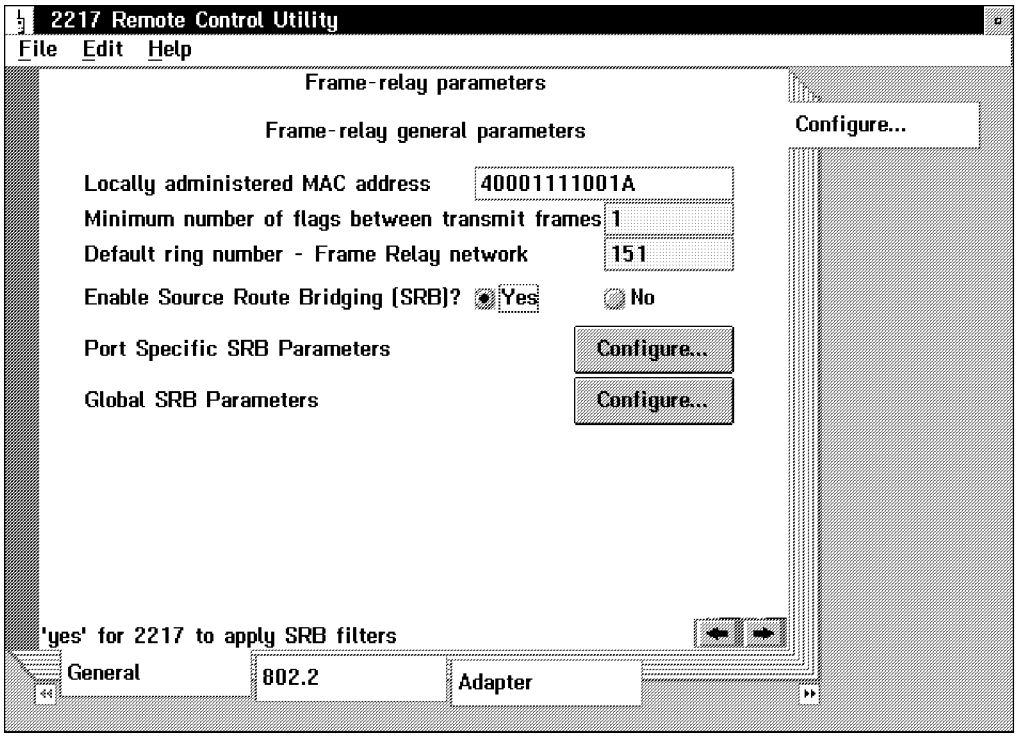


Figure 182. Frame Relay Parameters - Frame Relay General Parameters

- **Locally administered MAC address:** This field specifies, in IBM Token-Ring Network format, the 12-character hexadecimal medium access control (MAC) address for the 2217 on this frame relay interface.

  This value must be unique in the bridged network. It is used as the address for the 2217 on the virtual LAN segment representing the frame relay network.

- **Minimum number of flags between transmit frames:** This field specifies the minimum number of flags inserted between transmit frames. It is used when

the device at the other end of the communication's link cannot receive frames with only one intervening flag. The default value is 1.

- **Default ring number - Frame Relay network:** This field specifies the ring number of the frame relay network when viewed by the 2217 as a logical LAN. All bridges on the frame relay network should use the same ring number.

  The ring number used for this frame-relay network should be distinct from all ring numbers used on LANs and other networks that can be reached from this network.

- **Enable Source Route Bridging (SRB):**

  This radio button specifies whether source route bridging should be enabled on this port:

  - Yes to enable source route bridging
  - No if source route bridging is not enabled

  Note

  Simply disabling the routing of the protocols does not cause the protocol to be automatically bridged.

  Select **Yes** if you want the 2217 to apply the filters defined in the GSDSRB.INI file.

  The default filter file (supplied with the 2217) prevents bridging of IPX, NetBIOS, IP and SNA protocols since these are normally routed by the 2217. If you need to bridge any of those protocols or if you wish to apply other types of bridge filters, you must modify the filter file and download it using the RCU.

- **Port Specific SRB Parameters:** This option will be explained in 10.5.3, “WAC Port Specific SRB Parameters” on page 234.
- **Global SRB Parameters:** This option will be explained in 10.5.4, “Global SRB Parameters” on page 235.

10.5.3 WAC Port Specific SRB Parameters

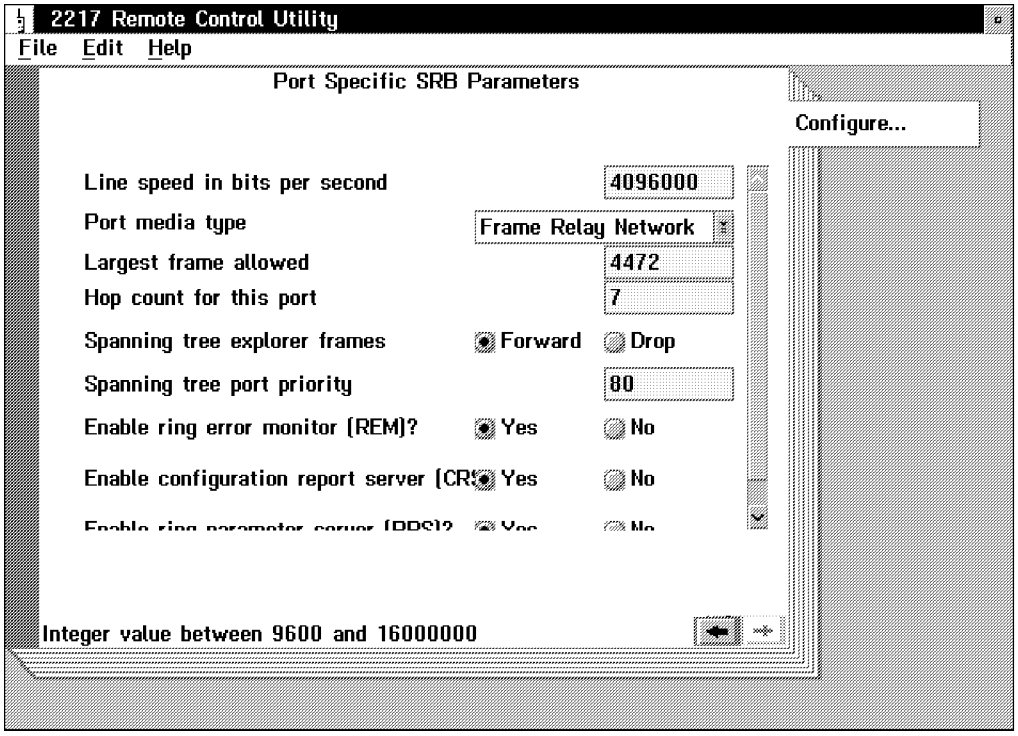


Figure 183. Frame Relay Parameters - Port Specific SRB Parameters

- **Line speed in bits per second:** This field specifies the speed, in bits per second (bps), of the attached local area network (LAN) or wide area network (WAN). The default value is 40960000.

  This value is used to calculate the relative path cost value for the LAN or link. The relative path cost is used by the spanning tree protocol to establish the most efficient path to the root node of the bridged network. Higher line speeds produce lower relative path costs.

- **Port media type:** This field specifies the underlying media attached to the bridge port. The default value is Frame Relay Network.

  Note: If the 2217's Source Route Bridge is enabled, the Ring Error Monitor (REM), Configuration Report Server (CRS), and Ring Parameter Server (RPS) servers are available.

- **Largest frame allowed:** This field specifies the size (in bytes) of the largest source-routed frame that can be sent or received through this bridge port. It must be smaller than the maximum size data unit (MSDU) for the associated medium access control (MAC). The default value is 4472. The MSDU value is specified in:

  - Maximum Size of a Transmitted Packet (frame relay)
  - Transmit Buffer Size (LAN). The bridge will round this value down to one of the following sizes: 516, 1500, 2052, 4472, 8144, 11407, or 17800.

- **Hop count for this port:** This field specifies the maximum number of bridges an explorer (broadcast) frame can cross in this bridged LAN before it is discarded. If the number of bridges an explorer frame has traversed before reaching this bridge is greater than or equal to this value, the frame is not forwarded. The default value is 7.

Most LANs have a limit of 7 hops, although special-purpose LANs may allow up to 13 hops. (The value is generally the same for all bridge ports in the LAN.)

- **Spanning tree explorer frames:** This option specifies how spanning tree explorer frames (single-route broadcast frames), received on this bridge port, are processed if Enable Spanning Tree Operation (on the Global Source Route Bridging Parameters configuration notebook panel) is disabled:
  - Forward to forward the frames (default value)
  - Drop to discard the frames
- **Spanning tree port priority:** This field specifies the priority used by the spanning tree protocol to break ties between ports to determine the Designated Port for the bridge. The default value is 80.

  Notes:

  1. The default is valid for most configurations.
  2. The lower the value, the higher the priority of the port.
  3. This value is not used directly by the spanning tree protocol; it is used to calculate a ranking of ports in priority from 0-15. The resulting port ranking is used as the Port Priority in bridge path data unit (BPDU) frames sent to other bridges.
- **Enable ring error monitor (REM):** This option specifies whether the Ring Error Monitor (REM) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the REM functional address to monitor beacon and soft error conditions on this LAN segment (default value)
  - No to disable the REM functional address
- **Enable configuration report server:** This option specifies whether the Configuration Report Server (CRS) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the CRS functional address to monitor configuration changes on this LAN segment (default value)
  - No to disable the CRS functional address
- **Enable ring parameter server:** This option specifies whether the Ring Parameter Server (RPS) functional address is enabled for the LAN segment attached to this port:
  - Yes to enable the RPS functional address to allow the 2217 to send initialization information to new stations attaching to this LAN segment (default value)
  - No to disable the RPS functional address

10.5.4 Global SRB Parameters

These parameters are similar to those configured for the LAN Adapter.

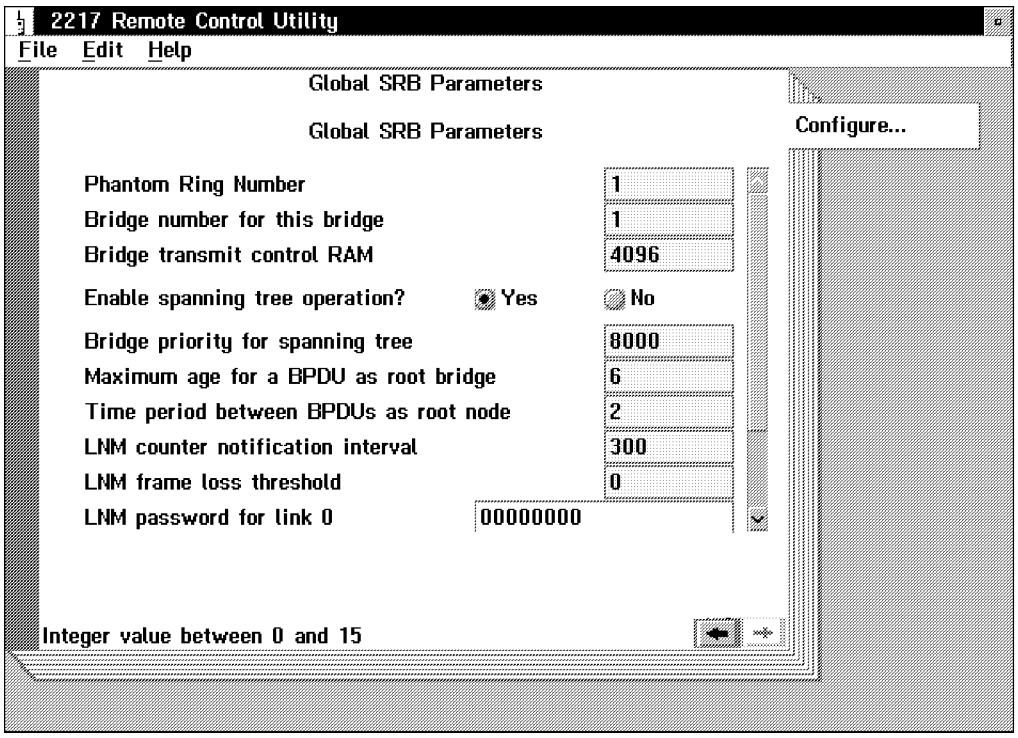


Figure 184. Frame Relay Parameters - Global SRB Parameters

10.5.5 IBM IEEE 802.2 parameters section

In the following panel, you configure the IEEE 802.2 values. In most cases, using the default values will provide the required support for your configuration.

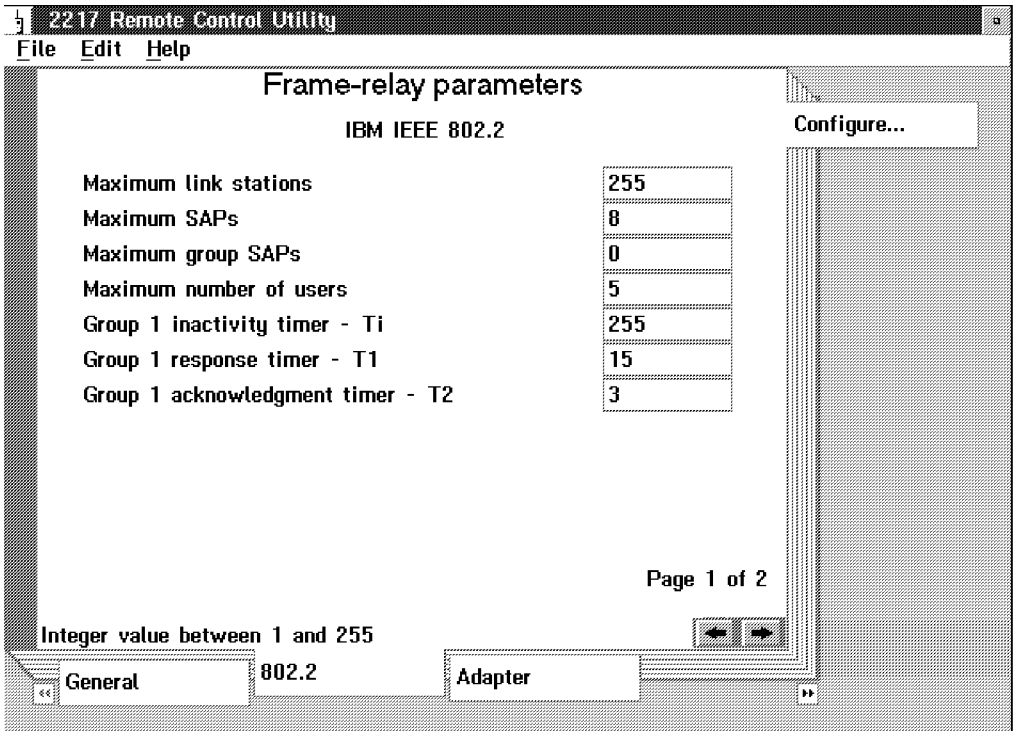


Figure 185. Frame Relay Parameters - IBM IEEE 802.2 (1 of 2)

- **Maximum link stations:** This field specifies the maximum number of link stations that can concurrently exist for all service access points (SAPs).

  Link stations exist at the end points of logical connections and can send or receive data with other link stations.

- **Maximum SAPs:** This field specifies the maximum number of link stations that can concurrently exist for all service access points (SAPs).

  Link stations exist at the end points of logical connections and can send or receive data with other link stations.

- **Maximum group SAPs:** This field specifies the maximum number of link stations that can concurrently exist for all service access points (SAPs).

  Link stations exist at the end points of logical connections and can send or receive data with other link stations.

- **Maximum number of users:** This field specifies the maximum number of applications that can concurrently use the protocol.

  Note: SNA is considered to be one user, and NetBIOS is considered to be one user.

- **Group 1 inactivity timer - Ti:** This field specifies a multiplier that determines how often the IEEE 802.2 protocol checks an inactive link to verify that the link is still operational. This value should be 5 to 10 times the value of Group 1 response timer - T1.

  Group 1 timer values are typically used for normal processing conditions.

- **Group 1 response timer - T1:** This field specifies a multiplier that determines how long the sending adapter waits for an acknowledgment before querying the partner's link station status. It should be large enough to account for the total delays that a frame would normally encounter within the sending workstation, the network, and the receiving workstation.

  Group 1 timer values are typically used for normal processing conditions.

- **Group 1 acknowledgment timer - T2:** This field specifies a multiplier used to determine the amount of time that an acknowledgment for a received frame is delayed when the number of frames sent is less than the Receive Window Count.

  Group 1 timer values are typically used for normal processing conditions.

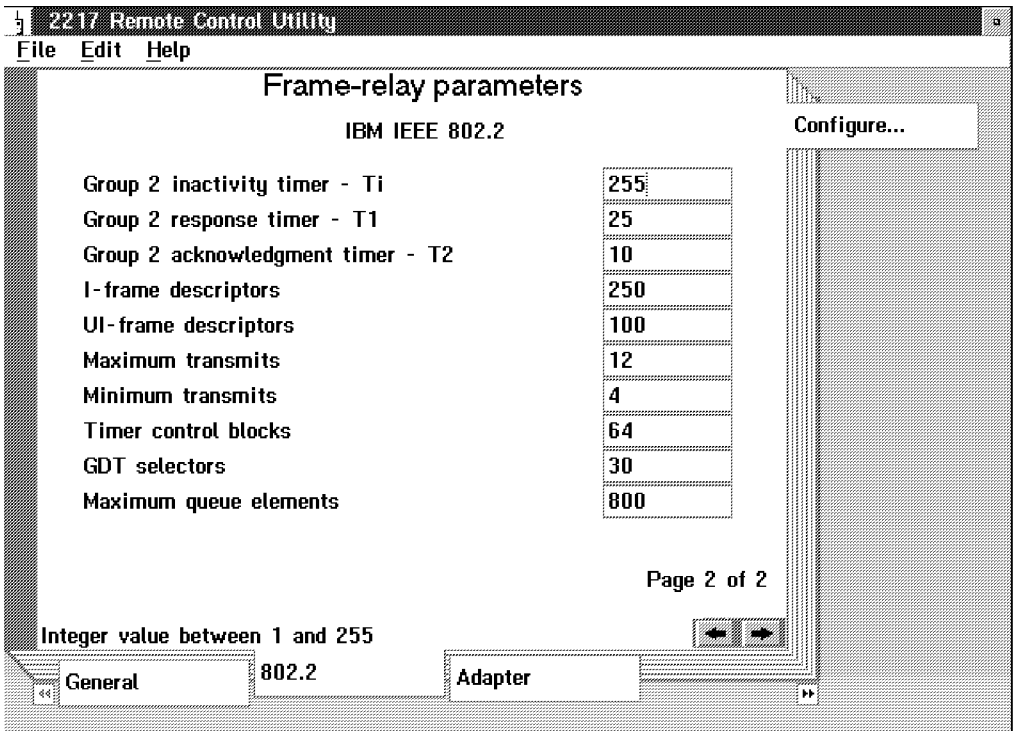


Figure 186. Frame Relay Parameters - IBM IEEE 802.2 (2 of 2)

- **Group 2 inactivity timer - Ti:** This field specifies a multiplier that determines how often the IEEE 802.2 protocol checks an inactive link to verify that the link is still operational. This value should be 5 to 10 times the Group 2 response timer - T1.

  Group 2 timer values are typically used when longer delays are expected (as in multiring environments).

- **Group 2 response timer - T1:** This field specifies a multiplier that determines how long the sending adapter waits for an acknowledgment before querying the partner's link station status.

  This value should be large enough to account for the total delays that a frame would normally encounter within the sending workstation, the network, and the receiving workstation.

  Group 2 timer values are typically used when longer delays are expected (as in multiring environments).

- **Group 2 acknowledgment timer - T2:** This field specifies a multiplier used to determine the amount of time that an acknowledgment for a received frame is delayed when the number of frames sent is less than the Receive Window Count.

  Group 2 timer values are typically used when longer delays are expected (as in multiring environments).

- **I-frame descriptors:** This field specifies the number of transmit I-frame command control blocks (CCBs) that can be in progress simultaneously.

- **UI-frame descriptors:** This field specifies the number of transmit UI, TEST, XID, and DIR-frame command control blocks (CCBs) that can be in progress simultaneously.

- **Maximum transmits:** This field specifies the number of packets the IEEE 802.2 protocol can simultaneously send to a network adapter driver.

  Notes:

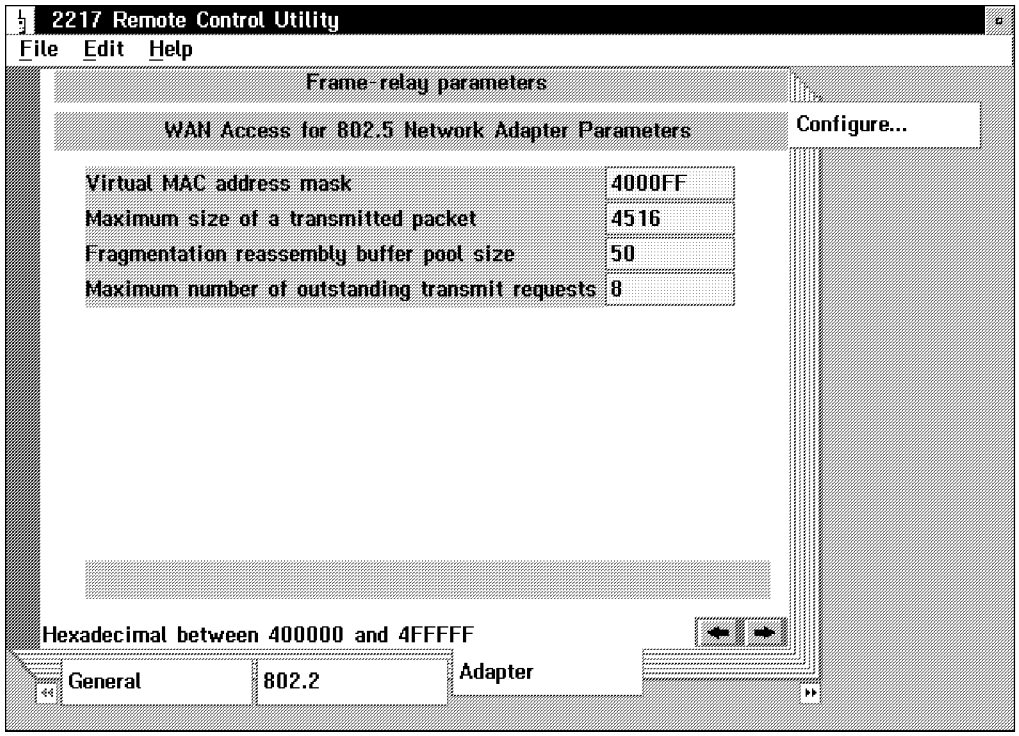
  1. When this value is low, the IEEE 802.2 protocol queues the packets internally.
  2. When this value is high, the network adapter driver queues the packets.

- **Minimum transmits:** When a network adapter driver returns an out-of-resource condition, the IEEE 802.2 protocol stops sending packets. This field specifies the number of transmission confirmations the IEEE 802.2 protocol must receive from the network adapter driver before sending additional packets.

  The value entered should be less than the value of Maximum Transmits.

- **Timer control blocks:** This field specifies the number of DirTimerSet command control blocks (CCBs) that can be in progress simultaneously.
- **GDT selectors:** This field specifies the number of internal data descriptors to allocate for global descriptor table (GDT) selectors.
- **Maximum queue elements:** This field specifies the amount of queue space in memory. A typical requirement is 200 times the value of Maximum Number of Users, or 1400, whichever is less.

10.5.6 Adapters Section



Adapter Parameters

Figure 187. Frame Relay Parameters - WAN Access for 802.5 Network

- **Virtual MAC address mask:** This field specifies the prefix used to develop virtual MAC addresses. The default value is 4000FF.

  A virtual MAC address is specified in the following format:

xxxxxx FFmmmm

where xxxxxx is the prefix specified in this field, FF is digits 7 and 8, and mmmm is the DLCI number of the virtual circuit to be used to reach a given destination node.

See the *2217 Nways Multiprotocol Concentrator User's Guide* for more information.

Virtual MAC addresses must be unique within the bridged network.

- **Maximum size of a transmitted packet:** This field specifies the maximum number of bytes accepted for transmission in a single request. The default value is 4516.

  To avoid fragmentation on the frame relay network, set this at least 14 less than the Maximum Frame Size to be Sent and Received on the Line Parameters panel.

- **Fragmentation reassembly buffer pool size:** This field specifies the storage (in kilobytes) used as a buffer pool for the reassembly of fragmented messages. The default value is 50.

  Note: This value should include one total message for each data link connection identifier (DLCI) that is sending fragmented messages concurrently.

- **Maximum number of outstanding transmit requests:** See page 30-21 of the *IBM 2217 Nways MpC User's Guide, Release 2*.

10.5.7 Protocol Section

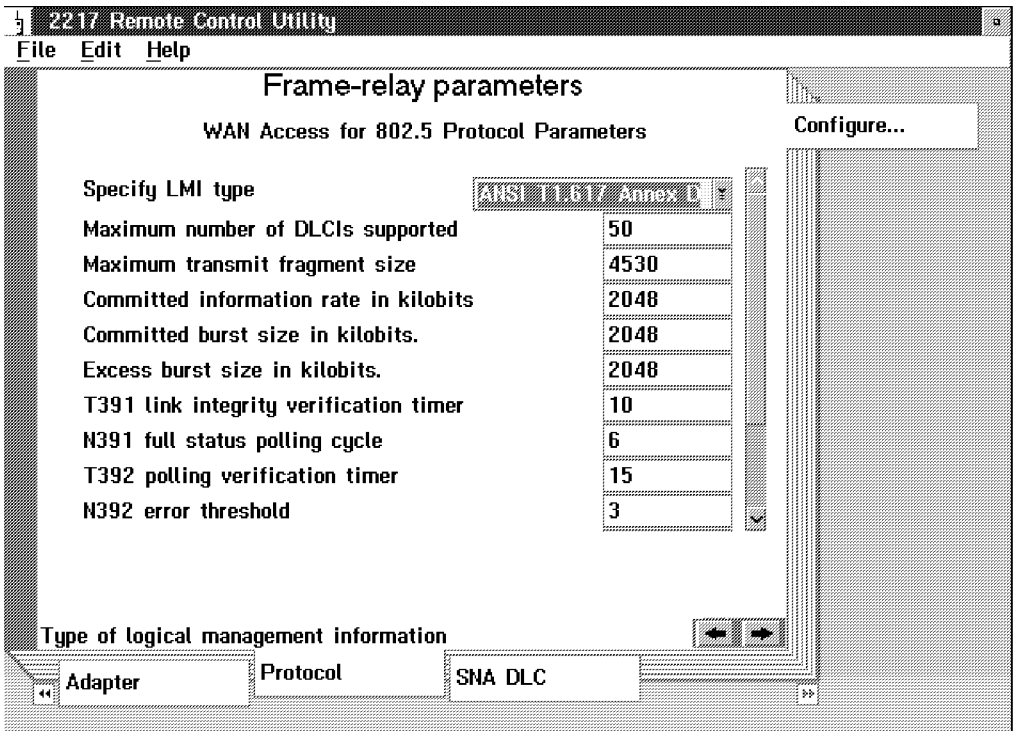


Figure 188. Frame Relay Parameters - WAN Access for 802.5 Protocol Parameters (1 of 2)

- **Specify LMI type:** This field specifies the type of Logical Management Information (LMI) used with the attached frame relay network:

- LMI Rev 1 for the commercial-sector-defined LMI Revision 1.0 (DLCI 1023 LMI).
- ANSI T1.617 Annex D for the US-standard ANSI T1.617 Annex D (DLCI 0 LMI). This is the default value.

- **Maximum number of DLCIs supported:** This field specifies the number of data link connection identifiers (DLCIs), or virtual circuits through a frame relay that the 2217 allows on this frame relay interface. The default value is 50.
- **Maximum transmit fragment size:** This field specifies the maximum number of bytes for fragments sent on the frame relay network. The default value is 4530.

  Note: The number must be the minimum size used by any data link connection identifier (DLCI) on the frame relay network.

  This value cannot be more than 14 bytes (FR header size) greater than the Maximum Frame Size to be Sent and Received value. If a larger number is entered, the driver adjusts it downward.
- **Committed information rate in kilobits:** This field specifies the traffic rate (in kilobits per second) guaranteed by the frame relay network provider per data link connection identifier (DLCI). The default value is 2048.

  If the offered load exceeds the committed information rate (CIR), the network may set the Discard Eligibility bit.
- **Committed burst size in kilobits:** This field specifies the number of bit times at the CIR rate over which the network provider assesses the offered load. The default value is 2048.

  Set this field to the CIR multiplied by the number of seconds over which the load should be measured.
- **Excess burst size in kilobits:** This field specifies the number of kilobits of data, in excess of the committed burst size, that the frame-relay network provider accepts in a burst. This excess burst of data may have the Discard Eligibility bit set by the network. Data that exceeds the excess burst size may be discarded by the network. The default is 2048.
- **T391 link integrity verification timer:** This field specifies the amount of time (in seconds) between logical management information (LMI) Status Inquiry messages sent from the 2217. The default value is 10.
- **N391 full status polling cycle:** This field specifies the number of Status Enquiries per Full Status Enquiry sent from the 2217. The default value is 6.

  After a remote channel is declared inactive, the network requires a number of successful poll events before declaring it active again.

  Note: This will take N x T seconds where:
  - N is the equivalent of N393 Monitored Events Count value for the network's connection to the remote.
  - T is the equivalent of T391 Link Integrity Verification Timer value.
- **T392 polling verification timer:** This field specifies the number of seconds the 2217 allows between received Status Enquiry messages. It is valid only if the 2217 is to receive Status Enquiries. The default value is 15.

Notes:

1. If a Status Enquiry message is not received within T392 seconds, an error is recorded.
2. This value should be greater than the value specified for T391LIVT at the network.

- **N392 error threshold:** This field specifies the number of Local In-Channel Signalling Link Reliability Errors and Local In-Channel Signalling Protocol Errors that can occur in any consecutive N393EVNT events before the frame-relay connection is declared inactive. The default value is 3.

  This value should be less than or equal to N393EVNT.

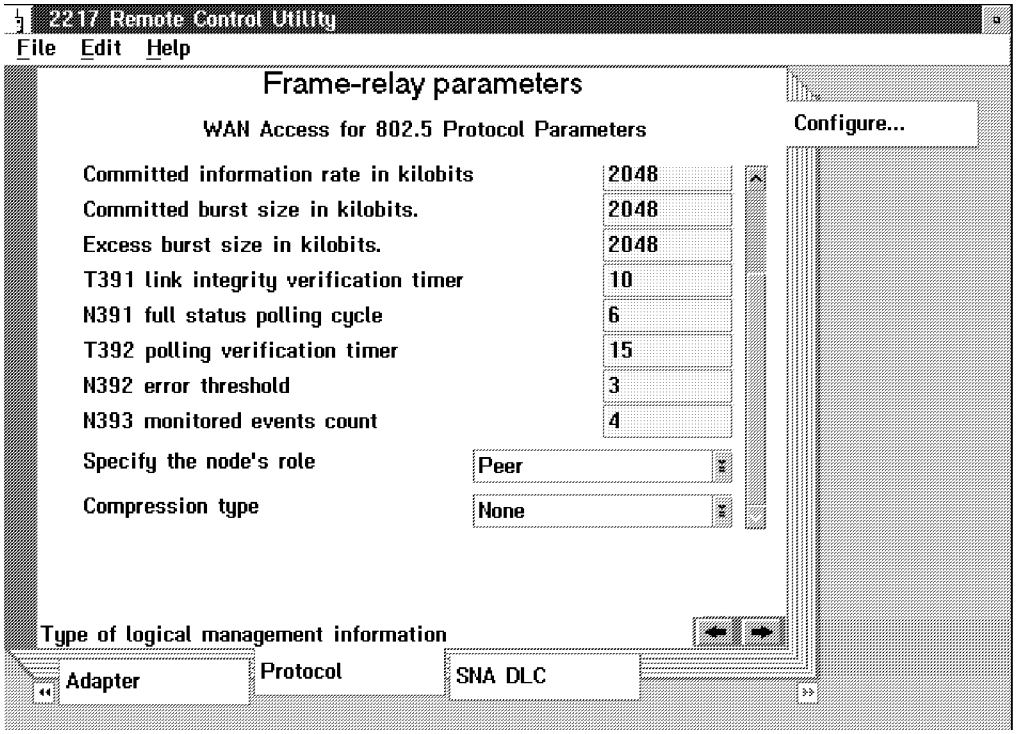


Figure 189. Frame Relay Parameters - WAN Access for 802.5 Protocol Parameters (2 of 2)

- **N393 monitored events account:** This field specifies the size of the sliding window used to determine whether a channel is active. The default value is 4.

  A Status Enquiry message is an example of a monitored event.

- **Specify the node's role:** This field specifies the role that the node performs within the wide area network (WAN):

  - Peer for a normal mesh-connected network (default value)
  - Hub for the center of a star-connected network
  - End Node for a node attached to a hub

- **Compression type:** This field specifies the maximum type of compression used by all data link connection identifiers (DLCIs) on this port:

  - None for no compression (default)
  - RLE for Run Length Encoding
  - LZ9 for Lempel-Ziv 9 Bit Encoding

- LZ10 for Lempel-Ziv 10 Bit Encoding

Notes:

1. LZ9 is the recommended compression type.
2. Specify None if one of the following is true:
   - Data is encrypted or compressed by a higher layer in the protocol stack.
   - Line speeds exceed 64 kbps. (The exact speed at which one should not use compression depends on processor speed, memory, data traffic characteristics, line errors and other environmental factors.)
3. Specify RLE if the data contains repeated characters (such as blanks).
4. Use Lempel-Ziv (LZ) compression if the data contains repeated patterns. (This applies to most data except encrypted and previously compressed.)

10.5.8 SNA DLC Section

SNA Data Link Control is not used when SRB over frame relay is enabled. However, you may need to configure an SNA connection in order to communicate with the IBM 2217 MpC.

For more information about how to configure SNA, please see Chapter 4, “SNA Gateway for Dependent LU Sessions” on page 87.

10.6 GSDSRB.INI File for IP, IPX, NetBIOS and SNA Bridge Filtering

If you use the supplied bridge filter, GSDSRB.INI, the IBM 2217 MpC routes traffic for the protocols it supports (SNA, TCP/IP, IPX and NetBIOS) and bridges traffic for the protocols it does not support over SNA.

To bridge traffic for SNA, TCP/IP, IPX and NetBIOS, you must first edit the GSDSRB.INI file and remove the entries (filters) for these protocols.

Note

Sample bridge filter file GSDSRB.INI is distributed in d:\2217rcu\samples subdirectory. To apply the updated filter file, use the Copy SRB filter to 2217 option in the MISC tab of Operations and Administration.

10.6.1 GSDSRB.INI File to Enable IPX Bridging

In this section, we show you how to enable IPX traffic in order to bridge this protocol using frame relay source route bridging. A similar procedure can be done to bridge other routed protocols (such as SNA, IP, and NetBIOS).

Note

SRB bridging is supported with WAN frame relay only.

```
;
;  Filter out both IP-based and ARP-related packets.
;  Filter out both IPX-based packets.
;  Filter out both NetBIOS-based packets.
;  Filter out both SNA-based packets.
;
[Ip]
  ;
  ;   Internet Protocol (IP) packets over LANs are encapsulated
  ;   using SNAP (Sub-Network Access Protocol) formats.  For LANs, the use
  ;   of a SNAP header is identified by the following fields having the
  ;   following values:
  ;
  ;      DSAP = 0xAA
  ;      SSAP = 0xAA
  ;      CTRL = 0x03
  ;
  ;   SNAP headers consist of 3-byte Organizationally Unique Identifiers
  ;   (OUIs) and 2-byte Protocol Identifiers (PIDs).  For IPs, these
  ;   fields are defined as:
  ;
  ;      OUI  = 0x000000
  ;      PID  = 0x0800
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the follow
  ;   eight bytes:
  ;
  FrameData      = "0xAAAA030000000800"
  FrameDataMask   = "0xFFFFFFFFFFFFFFFF"
  FrameDataOffset = 0
[Arps]
  ;
  ;   Address Resolution Protocol (ARP) packets over LANs are encapsulated
  ;   using SNAP (Sub-Network Access Protocol) formats.  For LANs, the use
  ;   of a SNAP header is identified by the following fields having the
  ;   following values:
  ;
  ;      DSAP = 0xAA
  ;      SSAP = 0xAA
  ;      CTRL = 0x03
  ;
  ;   SNAP headers consist of 3-byte Organizationally Unique Identifiers
  ;   (OUIs) and 2-byte Protocol Identifiers (PIDs).  For ARPs, these
  ;   fields are defined as:
  ;
  ;      OUI  = 0x000000
  ;      PID  = 0x0806
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the follow
  ;   eight bytes:
  ;
  FrameData      = "0xAAAA030000000806"
  FrameDataMask   = "0xFFFFFFFFFFFFFFFF"
  FrameDataOffset = 0
[Ipx_SNAP]
  ;
  ;   Internet Protocol Exchante (IPX) packets over LANs may be encapsulat
  ;   using SNAP (Sub-Network Access Protocol) formats.  For LANs, the use
  ;   of a SNAP header is identified by the following fields having the
```

```
  ;   following values:
  ;
  ;      DSAP = 0xAA
  ;      SSAP = 0xAA
  ;      CTRL = 0x03
  ;
  ;   SNAP headers consist of 3-byte Organizationally Unique Identifiers
  ;   (OUIs) and 2-byte Protocol Identifiers (PIDs).  For IPX, these
  ;   fields are defined as:
  ;
  ;      OUI  = 0x000000
  ;      PID  = 0x8137
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the foll
  ;   eight bytes:
  ;
  ; FrameData      = "0xAAAA030000008137"  <====Note: These 3 lines
  ; FrameDataMask   = "0xFFFFFFFFFFFFFFFF"          are commented out.
  ; FrameDataOffset = 0
[Ipx_SAP]
  ;
  ;   Internet Protocol Exchante (IPX) packets over LANs may be using
  ;   802.2 formats. For LANs, this uses Service Access Point (SAP) E0.
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the foll
  ;   two bytes:
  ;
  ; FrameData      = "0xE0E0"           <====Note: These 3 lines
  ; FrameDataMask   = "0xFFFF"                    are commented out.
  ; FrameDataOffset = 0.
[NB_SAP]
  ;
  ;   NetBIOS packets over LANs use connection oriented frames that foll
  ;   802.2 formats. For LANs, this uses Service Access Point (SAP) F0.
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the foll
  ;   eight bytes:
  ;
  FrameData      = "0xF0F0"
  FrameDataMask   = "0xFFFE"
  FrameDataOffset = 0
[SNA_SAP]
  ;
  ;   System Network Arch. packets over LANs use connection oriented fra
  ;   that follow 802.2 formats. For LANs, this uses Service Access Poin
  ;   (SAP) F0.
  ;
  ;   Hence, starting at the DSAP field, each LAN-based ARP has the foll
  ;   eight bytes:
  ;
  FrameData      = "0x0404"
  FrameDataMask   = "0xFFFE"
  FrameDataOffset = 0
[Frames2217]
  ;
  ;  Discard both IP and ARP frames.
  ;
  ; AnyOf = Ip, Arps, Ipx_SNAP, Ipx_SAP, NB_SAP, SNA_SAP
  ;
```

```
AnyOf = Ip, Arps, NB_SAP, SNA_SAP        <====Note: IPX-SNAP and
                                                    IPX-SAP entries rem

[FILTER]
   ;
   ;  Assuming that all ports need filtering. The GeneralList will filter
   ;  both LAN and WAC card.
   ;
   ;
   GeneralList = Frames2217
```

10.6.2 Summary

The sample filter program was edited to allow IPX data to be bridged by the IBM 2217 MpC. In summary, to be able to bridge IPX traffic, you must do the following:

- Remove Ipx_SNAP filters for the IPX frame formats using Sub-Network Access Protocol.
- Remove Ipx_SAP filters for the IPX frame formats using 802.2 frame formats.
- In Frames2217, remove the IPX entries as required for the IPX frame formats you are using.
- Apply SRB filter file

In the following figure, we show you how to apply the updated SRB filter file. You may want to rename or back up the file before you do any changes to it.

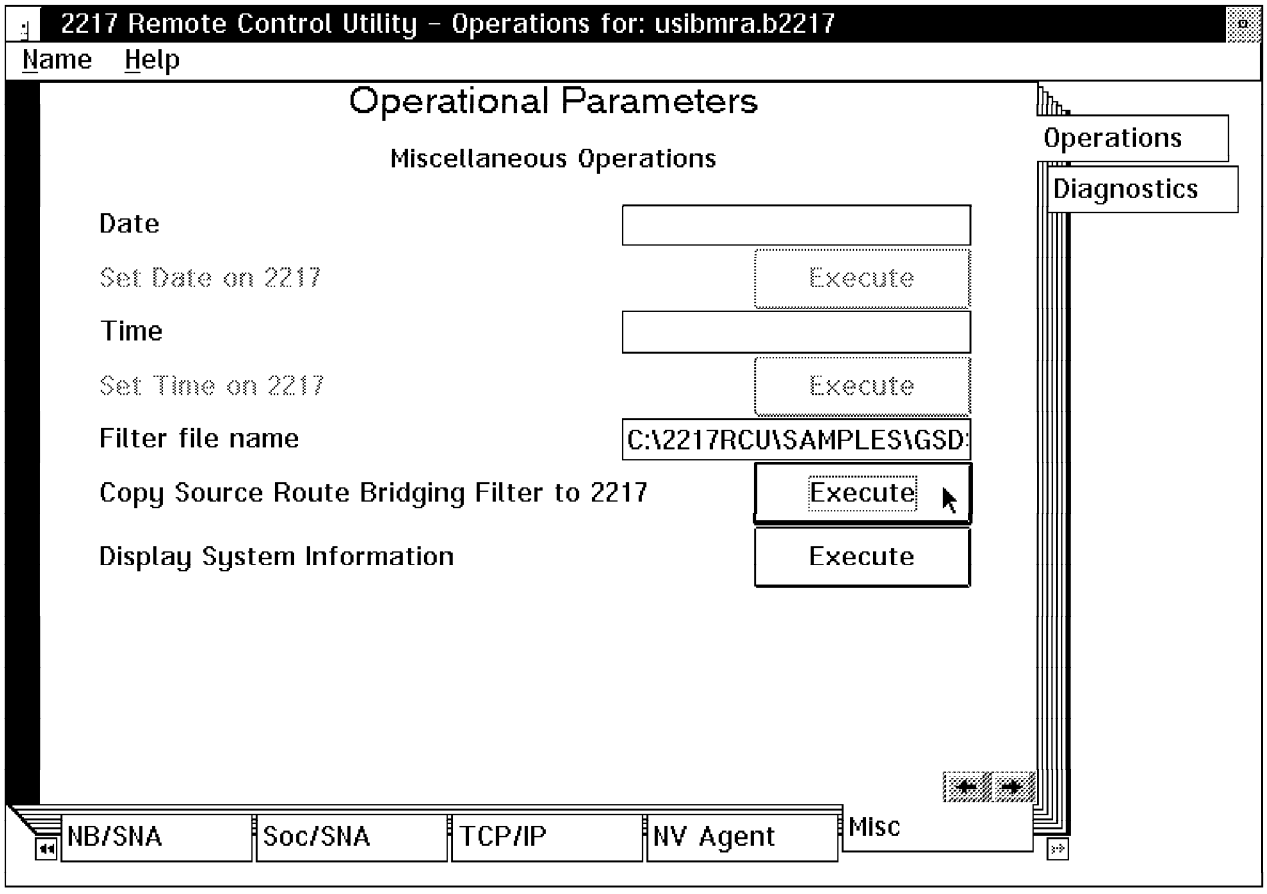


Figure 190. Applying SRB Filter File to IBM 2217 MpC

Note

It is important that you specify the complete file specification; otherwise, the apply option will not be enabled.

10.7 Monitoring and Control of Source Route Bridging and Frame Relay

You can always communicate with the IBM 2217 MpC in order to monitor and control the source route bridging function over frame relay. For example, you may obtain and display frame relay statistics, source route bridging ports and so on.

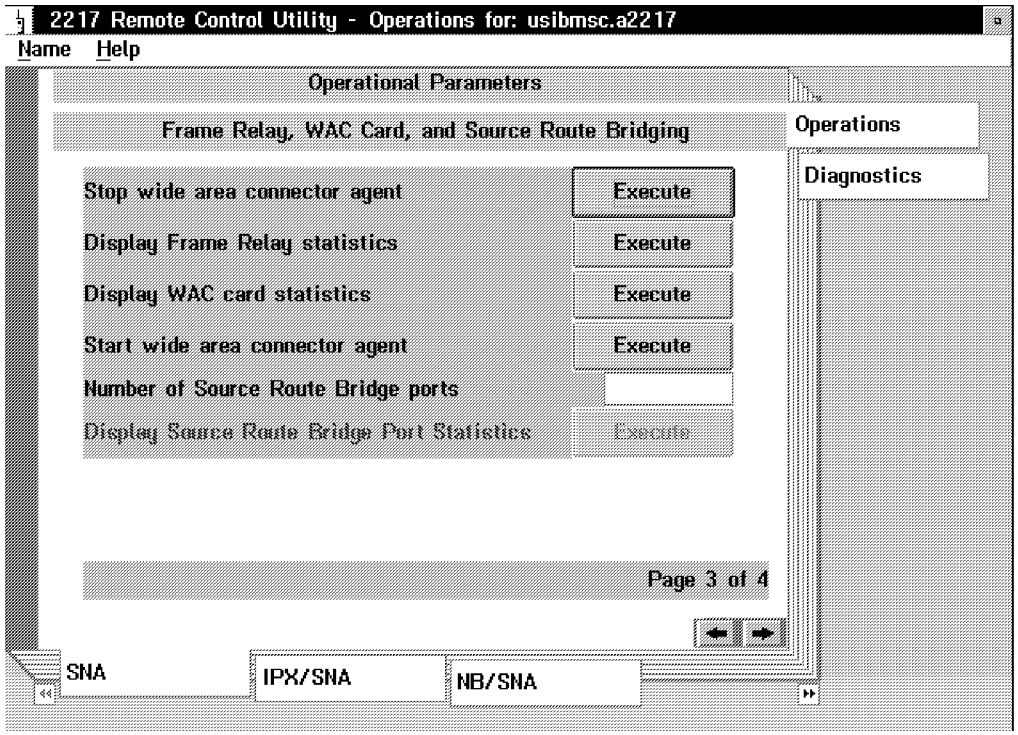


Figure 191. Operational Parameters: FR, WAC, and SRB

Chapter 11. ISDN Support in IBM 2217 MpC

IBM 2217 Nways MpC Release 2.0 has included support to connect to Integrated Services Digital Networks (ISDN). In this chapter, we show you how this support has been implemented in the IBM 2217 MpC and what is required to configure SDLC and X.25 over ISDN networks.

Note

IBM 2217 Nways MpC Release 2.0 requires APAR IR32542 to support ISDN.

11.1 ISDN Support - Overview

The IBM 2217 MpC using integrated services digital network (ISDN) provides another type of wide area network (WAN) attachment for your SNA backbone network.

ISDN is a network technology that provides end-to-end digital connections for a wide range of voice and nonvoice communication services over normal digital telephone lines. ISDN telephone line usage can cost significantly less than leased lines because, in most cases, you are charged only for the length of time you use the line regardless of whether you are transferring voice or data.

One of the goals of ISDN technology is to define a limited number of multipurpose user interfaces for access to the network. With standard interfaces that use a common set of rules, different types of user equipment and applications can use the network services. ISDN standards are governed by the International Telecommunication Unit - Telecommunications Standardized Sector (ITU-TS), formerly CCITT.

11.1.1 Advantages of ISDN

Applications can take advantage of ISDN's higher data rate and ease of installation. One of the most common uses is to connect two or more remote local area networks (LANs). ISDN, while not as fast as a LAN, allows wide area networking at speeds greater than or equal to those supported by most permanent connections. This considerable improvement over asynchronous communications is due to the elimination of modems and a reduction in data transmission overhead. ISDN sends a block of data instead of a character at a time.

If your local telephone company supports ISDN, no additional wiring is required to use ISDN connections. For this reason, ISDN is a good choice for use as an auxiliary communications line to improve network performance during peak loads. ISDN can also be used as a backup to provide continued service when problems are detected on the primary networks.

11.1.2 ISDN Hardware

The ITU-TS standard defines a four-wire, duplex, RJ-11 connection for wiring (for example, typical telephone wires). It also defines a time-division multiplex for the electrical interface. The clocking rate is 19.2 kbps. The multiplexing divides the 19.2 kbps into:

- A 16-kbps signaling channel (D-channel)
- Two 64-kbps channels for information (B-channels)
- 48 kbps reserved for overhead

11.1.3 ISDN Channels

The digital telephone line that ISDN uses is logically organized into three channels: one D-channel and two B-channels. This organization is similar to having three telephone calls going on simultaneously with one telephone. Although ISDN provides other channel combinations, this 2B + D channel configuration is the most common and is called the basic rate.

The telephone wiring is used for establishing and handling a connection through the D-channel; voice and data are transmitted over that same wire through the B-channels. The data can be transmitted in any synchronous communications protocol. This flexibility means that existing applications can now use ISDN transmission instead of leased or switched lines through modems.

ISDN's basic rate interface has one 16-kbps D-channel and two 64-kbps B-channels. Combined, the data rate is 14.4 kbps over the same telephone cable.

11.1.3.1 D-Channel

The D-channel is used to place an outgoing call, receive an incoming call, and disconnect a completed call. Because ISDN is a synchronous digital network, all D-channel information is in an ITU-TS standard message format. Standard message formats define all functions dealing with the physical connection of two pieces of terminal equipment through a switched telephone network.

The standardization of message formats by the ITU-TS is the open system (worldwide) for the switched telephone network. Equipment provided by any terminal vendor can connect and use any other vendor's ISDN. In addition to signaling information, X.25 can use the D-channel for packet switching of data to avoid an additional connect charge for each call. However, the number of X.25 packet switching connections is limited by the telephone switch to approximately 150.

By using X.25 protocols, users can transfer data packets over the D-channel. The D-channel acts as a connection into a packet network and a terminal can exchange data with other terminals using standard X.25 protocols. This avoids the time delay and charge to make a connection, but it is slower for large data transfers.

11.1.3.2 B-Channel

ISDN supports multiple lines with multiple services. Each B-channel operates as a completely separate telephone line on which the IBM 2217 MpC can dial a different telephone number.

Data is transferred at a rate of 64 kbps on each B-channel. If rate adaptation is required because of networking constraints, throughput drops to 56 kbps, but channel speed remains at 64 kbps. The ISDN ITU-TS standard for the B-channel is for clear channel use. This means that no restriction can be imposed by the network as to the content of the information exchanged between any two pieces of terminal equipment that have a physical connection made by D-channel signalling.

This clear channel standard allows the terminal equipment vendor to offer maximum flexibility in network functions to the end user. For example, if you have an IBM 2217 MpC with an ISDN adapter, you can place a call to an SNA host system to use the SNA Gateway function. At the same time, you can place a call to another 2217 on the other B-channel for APPC multiprotocol traffic.

11.1.4 Support for the X.25 Protocol

The IBM 2217 MpC establishes X.25 connections for SNA communication. For ISDN, the IBM 2217 MpC supports X.25 connections using Case A and Case B ISDN services on the B-channels and the D-channel:

- Case A is an ISDN service that provides access to a packet-switching data network (PSDN) over a B-channel for a circuit-switched connection between packet-switched devices.
- Case B is an ISDN service that provides access to packet handling services over the B-channels and the D-channel.

11.1.5 Support for the SDLC Protocol

The IBM 2217 MpC also supports SDLC connections via ISDN. To establish ISDN circuit-switched connections to 37xx controllers, use an IBM ISDN Terminal Adapter (7820) or another terminal adapter that converts a data stream between ISDN and V.35. This terminal adapter is configured to establish the call using the D-channel and to route to a port that is V.35.

11.1.6 ISDN Requirements

Before configuring the IBM 2217 MpC for ISDN connections, obtain the following values from your ISDN service provider:

- ISDN subscriber telephone number
- Switch protocol type

The following values for the first and second B-channels may also be provided, depending on your switch protocol type:

- Service profile identifier (SPID)
- Terminal endpoint identifier (TEI) for the first and second B-channel
- Directory number
- X.25 TEI value, if you are using X.25 on the D-channel

You must enter these values when you configure the ISDN adapter on the 2217.

11.1.7 Switched Call Directories for ISDN

For switched X.25 or SDLC access via ISDN, configure the following ISDN call directories:

- ISDN Outgoing Call Directory: This directory is configured if the 2217 will be initiating calls and contains a list of remote parties to which the IBM 2217 MpC can establish a connection. Each entry in the directory has an entry name, a list of telephone numbers, and other information describing the call.
- ISDN Incoming Call Directory: This directory is configured if the 2217 will be receiving incoming calls and may contain a list of remote parties that can establish a connection with the 2217. Each entry in the directory has an entry name and the call routing criteria that must be satisfied for the call to be routed to the 2217. If remote party numbers or other routing criteria are not specified, the IBM 2217 MpC accepts any call.

Note

If you are using X.25 on the D-channel only, call directories are not needed.

11.2 SDLC over ISDN Configuration

In this section, we show you how to configure ISDN in order to support SDLC over ISDN B-Channel. The following figure depicts this configuration:

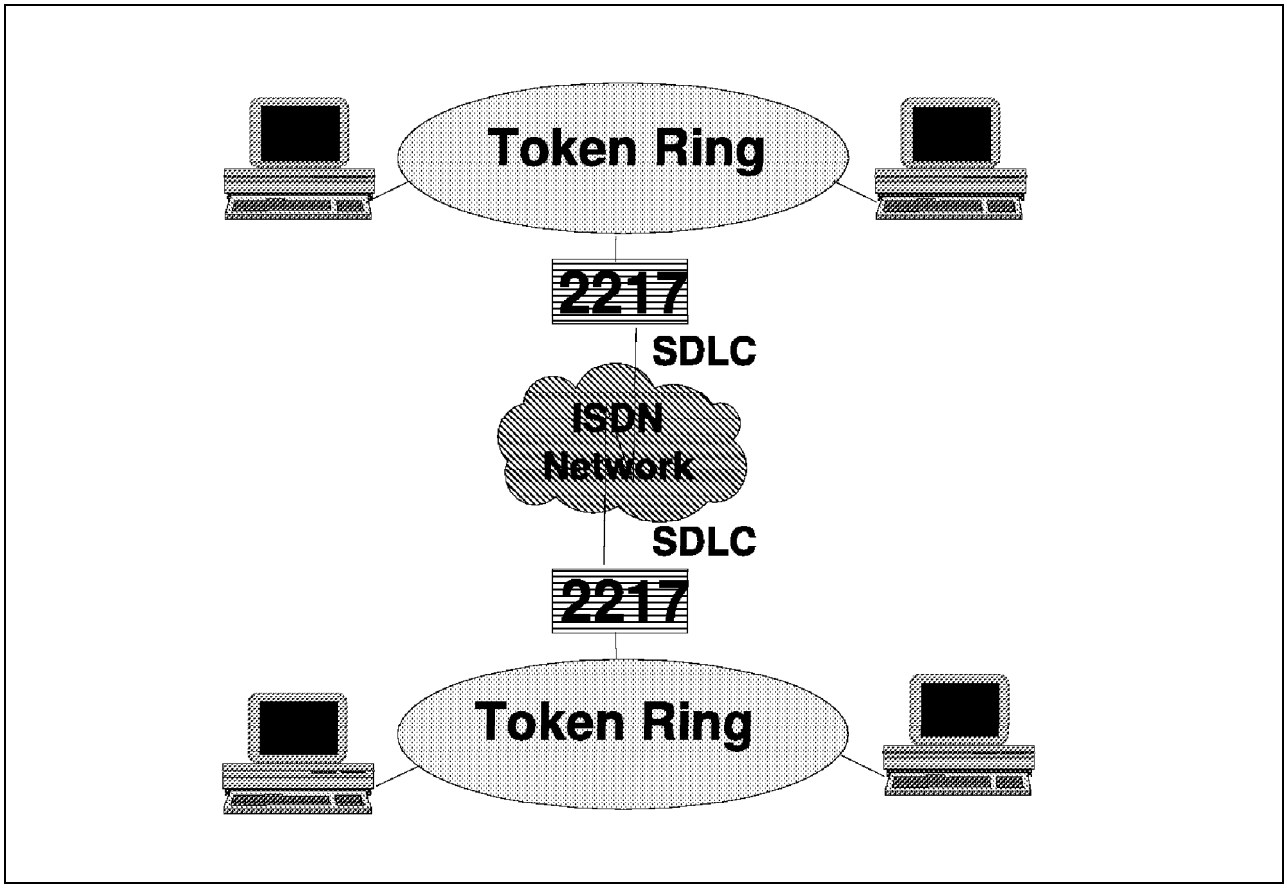


Figure 192. SDLC over ISDN Configuration

When you configure SDLC over ISDN, you basically need to define the following profiles:

- **ISDN Adapter:** In this profile you configure the ISDN parameters obtained from your ISDN servicer provider.
- **SDLC SNA Link:** This profile is optional if you do not want to initiate the link from the IBM 2217 MpC. If you do not explicitly define a link, the IBM 2217 MpC will not be able to start the link activation procedure (XID exchange), but it can still accept incoming implicit links.
- **SDLC profile:** This profile is required. In this profile, you specify the characteristics of the SDLC connection.
- **Switched:** This profile includes the ISDN outgoing and/or incoming directories.

Note

You can always configure an IBM 2217 MpC to support both incoming and outgoing calls. However, in this chapter we separate the configurations in order to better understand what is required for both.

11.2.1 Initiating an SDLC over ISDN Connection

The following figure illustrates the profiles you need to configure in order to initiate a SDLC over ISDN connection.

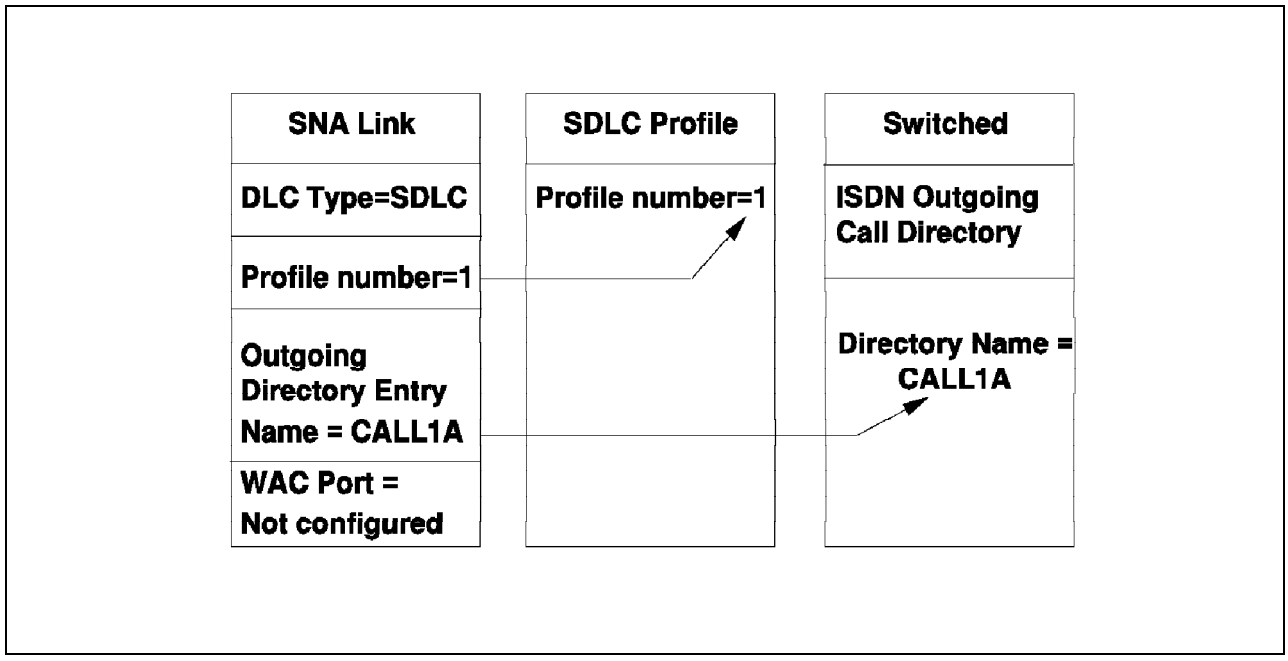


Figure 193. Initiating a SDLC over ISDN connection

11.2.1.1 ISDN Adapter Configuration (Local SDLC)

In this configuration panel, you enter the configuration values from your ISDN service provider subscription, such as the ISDN switch protocol, subscriber number, service provider identifiers and directory numbers.

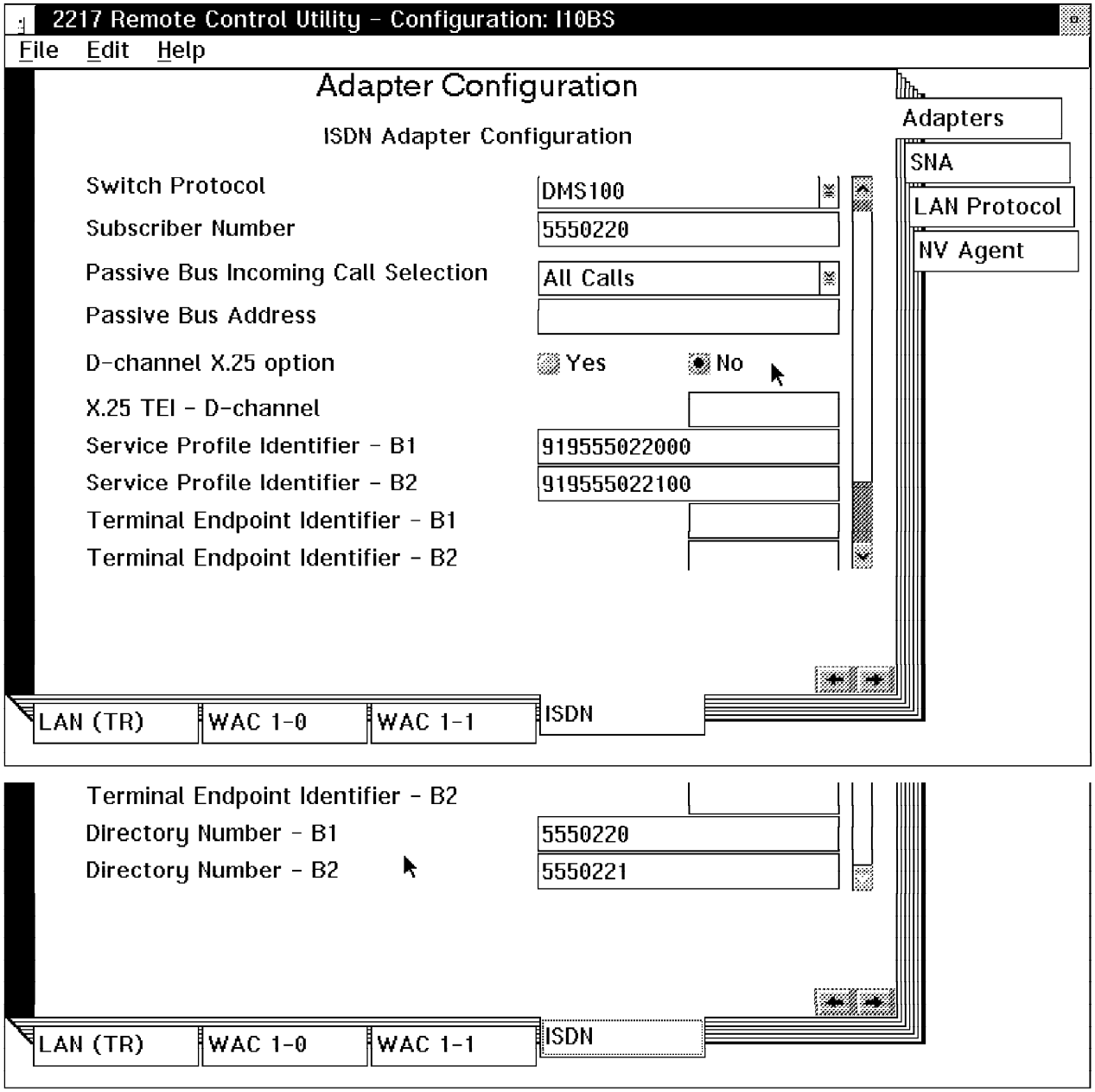


Figure 194. ISDN Adapter Configuration

11.2.1.2 SNA Link (SDLC)

If you want to be able to start the SDLC over ISDN link from the IBM 2217 MpC, you must configure an explicit link for SDLC.

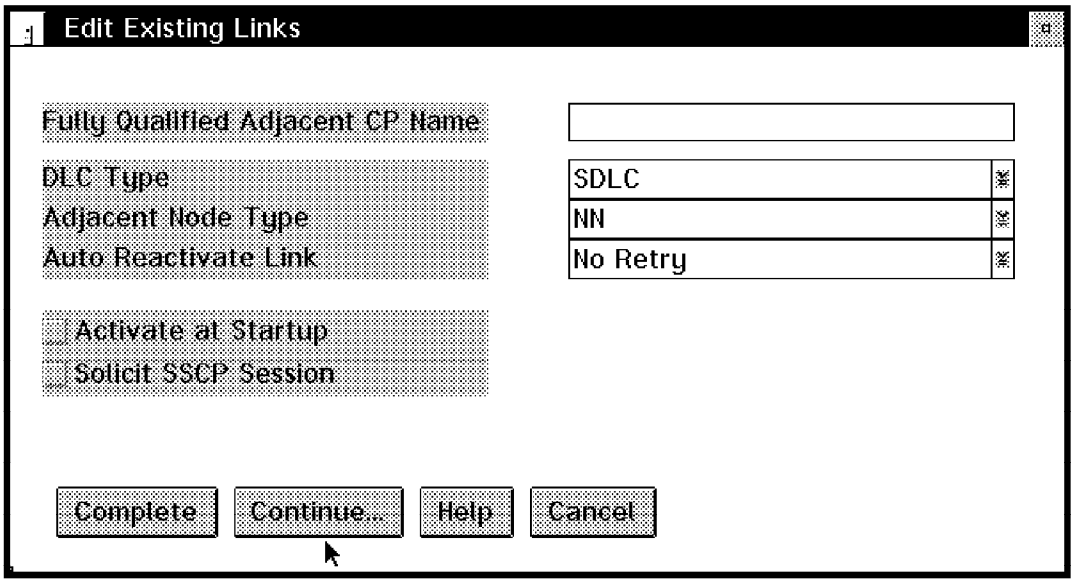


Figure 195. SDLC Link

Next, select **Continue...** to define additional link parameters. For ISDN, specify the outgoing directory entry name. You will also need to provide the SDLC profile number in order to point to the proper SDLC configuration.

The following parameters are configured as shown in Figure 196 on page 256:

- **Destination Address:** Enter the secondary SDLC address. In this configuration it is 01.
- **SDLC Profile Number:** Enter the SDLC profile number you will define for the link. In this sample configuration it is 1.
- **Outgoing Directory Entry Name:** Enter the name of the outgoing directory entry. In this configuration it is CALL11A.
- **Maximum I-Field Size:** This field is the message frame size plus nine bytes for the SNA headers (TH and RH). In this configuration it is 265 (256 + 9) bytes. If SNA messages are larger than this value, segmentation occurs.
- **Send Count:** Messages to be sent before acknowledge. This value is normally negotiated in the XID3 exchange.
- **Receive Count:** Messages to be received before acknowledge. This value is normally negotiated in the XID3 exchange.
- **Primary Receive Timer:** This field specifies (in tenths of a second) the maximum amount of time allowed before the primary link station must receive a frame from the secondary link station.
- **WAC Connector Port:** Must be set to Not Configured in order to use ISDN.
- **Connection Type:** Specify Auto Dial. You must also provide the name of the outgoing call directory entry containing the phone number to be called.
- **CP-CP Session Support:** End nodes and network nodes will normally have this option set. Select this option when you have SNA Gateway sessions (dependent LU sessions) but still want to have CP-CP sessions with your partner node.
- **Preferred NN Server:** This option is valid when the IBM 2217 MpC is defined as an end node (EN) and is connected to multiple network nodes (NNs). In

this case, select this option for the logical link to your preferred network node. The IBM 2217 MpC will try to establish CP-CP sessions (internal APPN sessions) using this link.

- **Initialize with SNRM:** Use only if you are connecting the IBM 2217 MpC to an old device that does not support the XID command to establish the link connection.

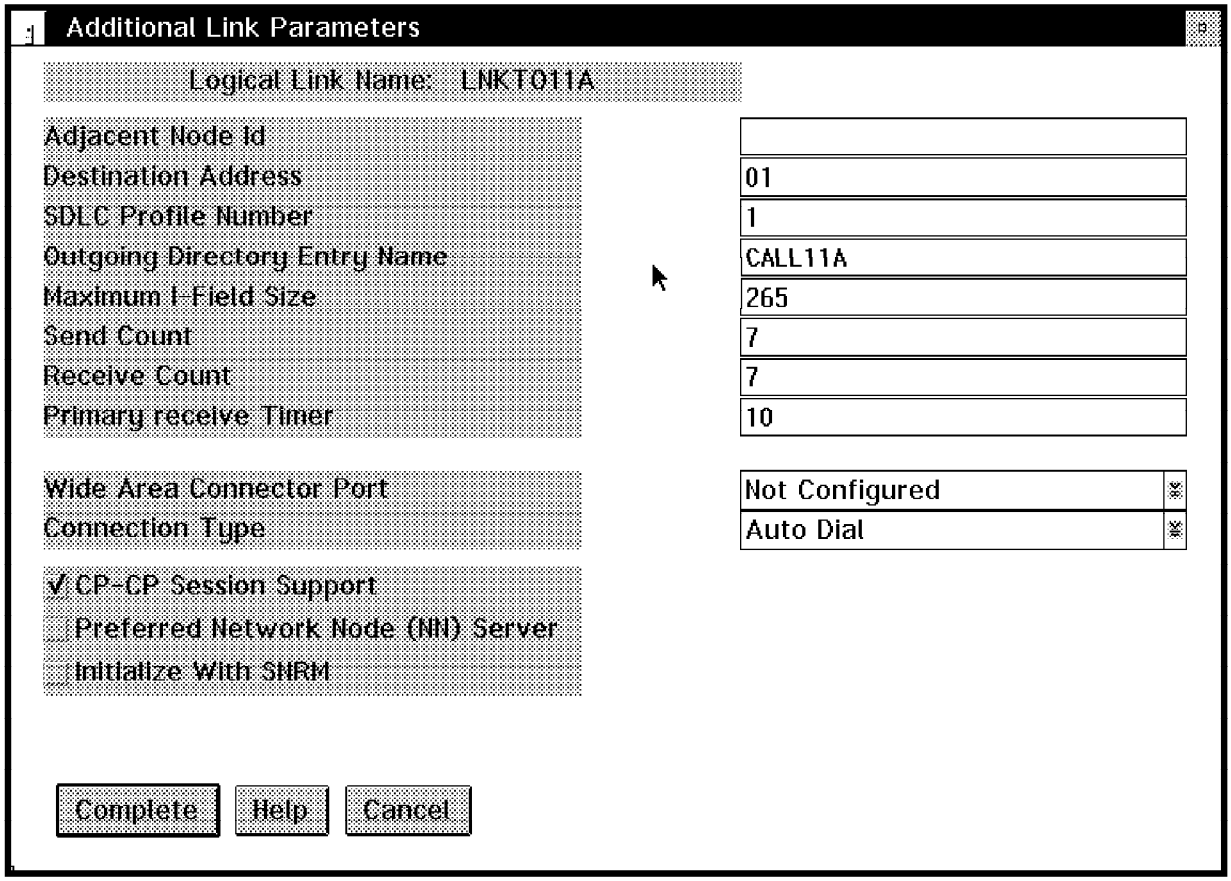


Figure 196. Logical Link Name: LNKTO11A

11.2.1.3 SDLC Profile

In this configuration panel, define the SDLC link characteristics. In this configuration, we are not accepting incoming calls since we are only *initiating* the connections.

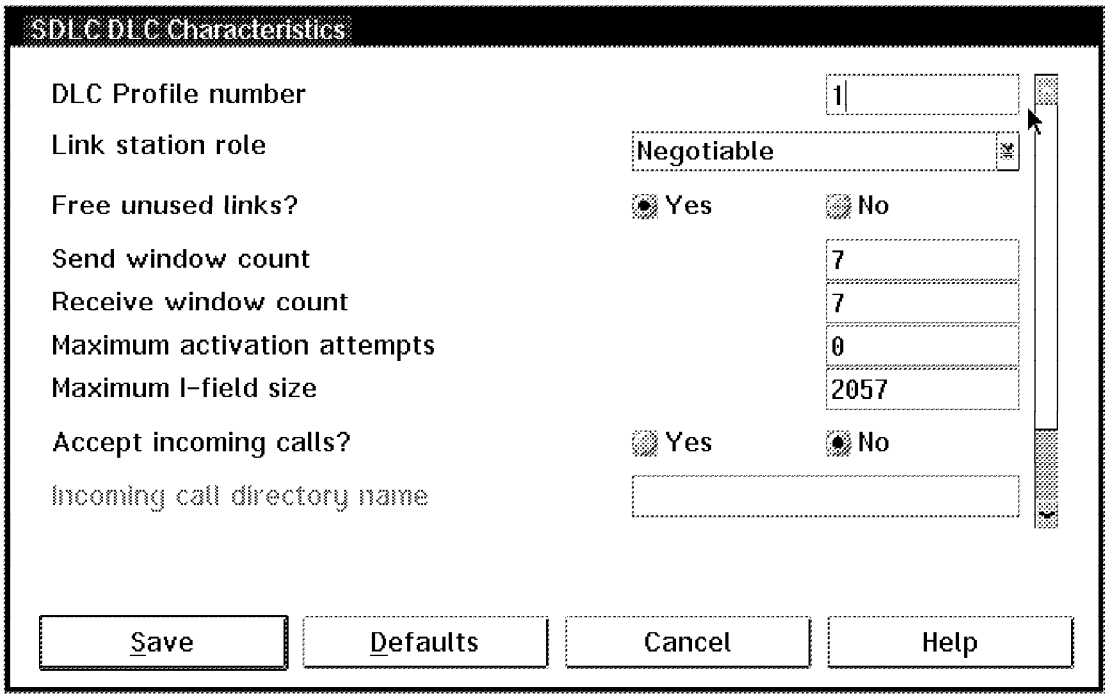


Figure 197. SDLC Profile

11.2.1.4 ISDN Outgoing Call Directory

In this panel you need to define the ISDN outgoing call directory to enter the number to be called. Select the **Switched** folder to get to this configuration panel. The directory name is specified in the SNA link (SDLC) previously defined. In this configuration it is CALL11A.

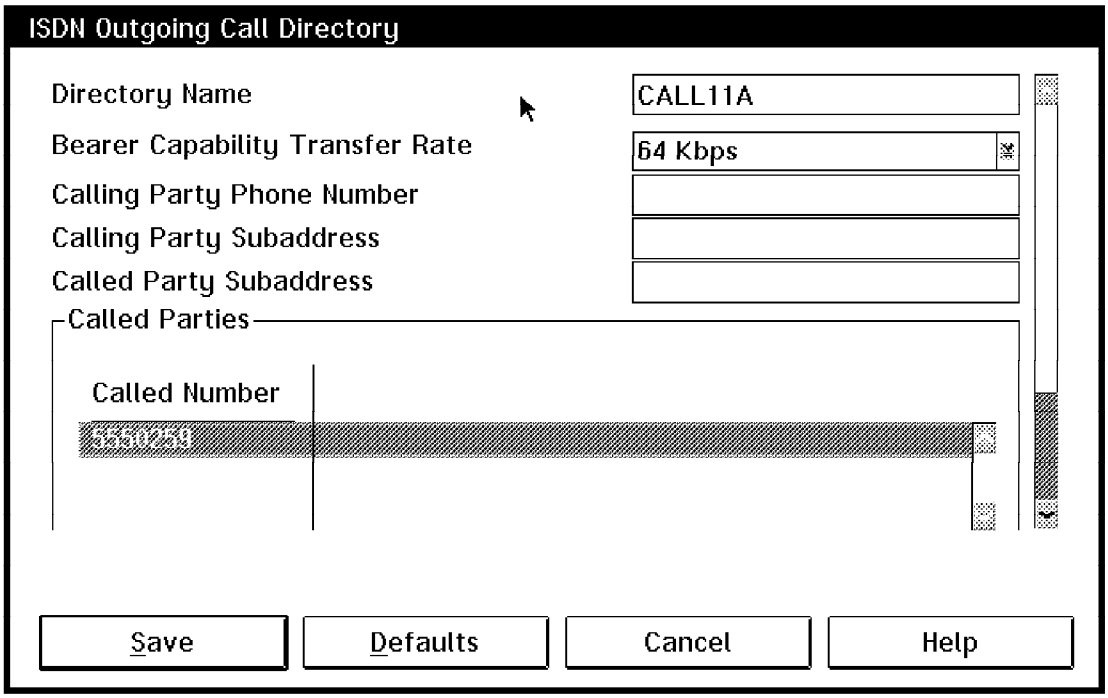


Figure 198. ISDN Outgoing Call Directory

11.2.2 Accepting an SDLC over ISDN Connection

In this section, we configure an IBM 2217 MpC to accept incoming calls. You may want to define an explicit SNA link. If an explicit link is not defined, IBM 2217 MpC will generate an implicit link. To verify what logical links are implicitly defined, you may want to display the IBM 2217 MpC logical links using the RCU Operations and Administration panels.

The following figure (shown in Figure 199) illustrates the profiles you need to configure in order to accept an SDLC over ISDN connection. As it was previously indicated, the SNA link profile is optional.

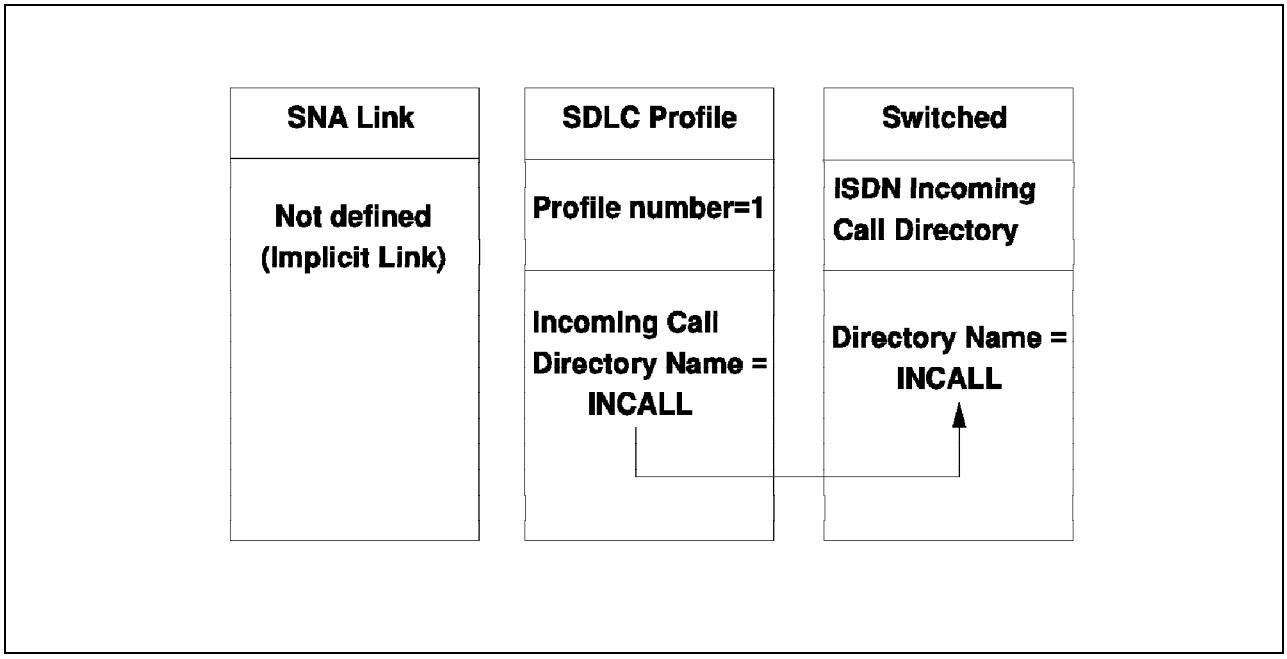


Figure 199. Accepting an SDLC over ISDN Connection (Implicit Link)

11.2.2.1 ISDN Adapter Configuration (Remote SDLC)

In this configuration panel, you may enter the configuration values from your ISDN service provider subscription such as the ISDN switch protocol, subscriber number, service provider identifiers and directory numbers.

For more information about ISDN Adapter Configuration Parameters, see 11.2.1.1, “ISDN Adapter Configuration (Local SDLC)” on page 254

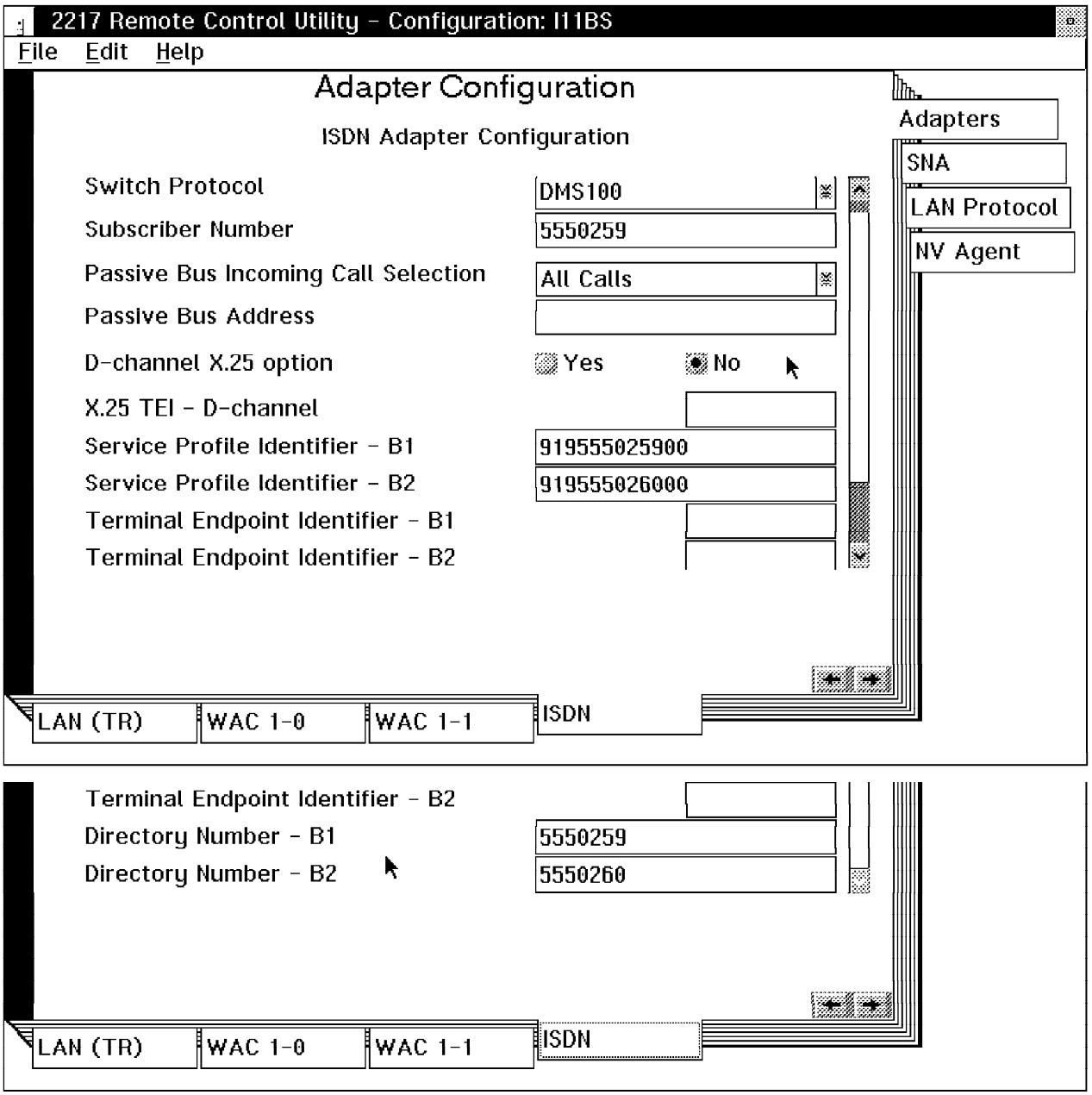


Figure 200. ISDN Adapter Configuration

11.2.2.2 SDLC DLC Characteristics

In this profile, define the SDLC characteristics for your connection. For incoming calls, you configure the following options:

- Select **Yes** beside Accept incoming calls?
- Enter the incoming call directory name. In this configuration it is INCALL.

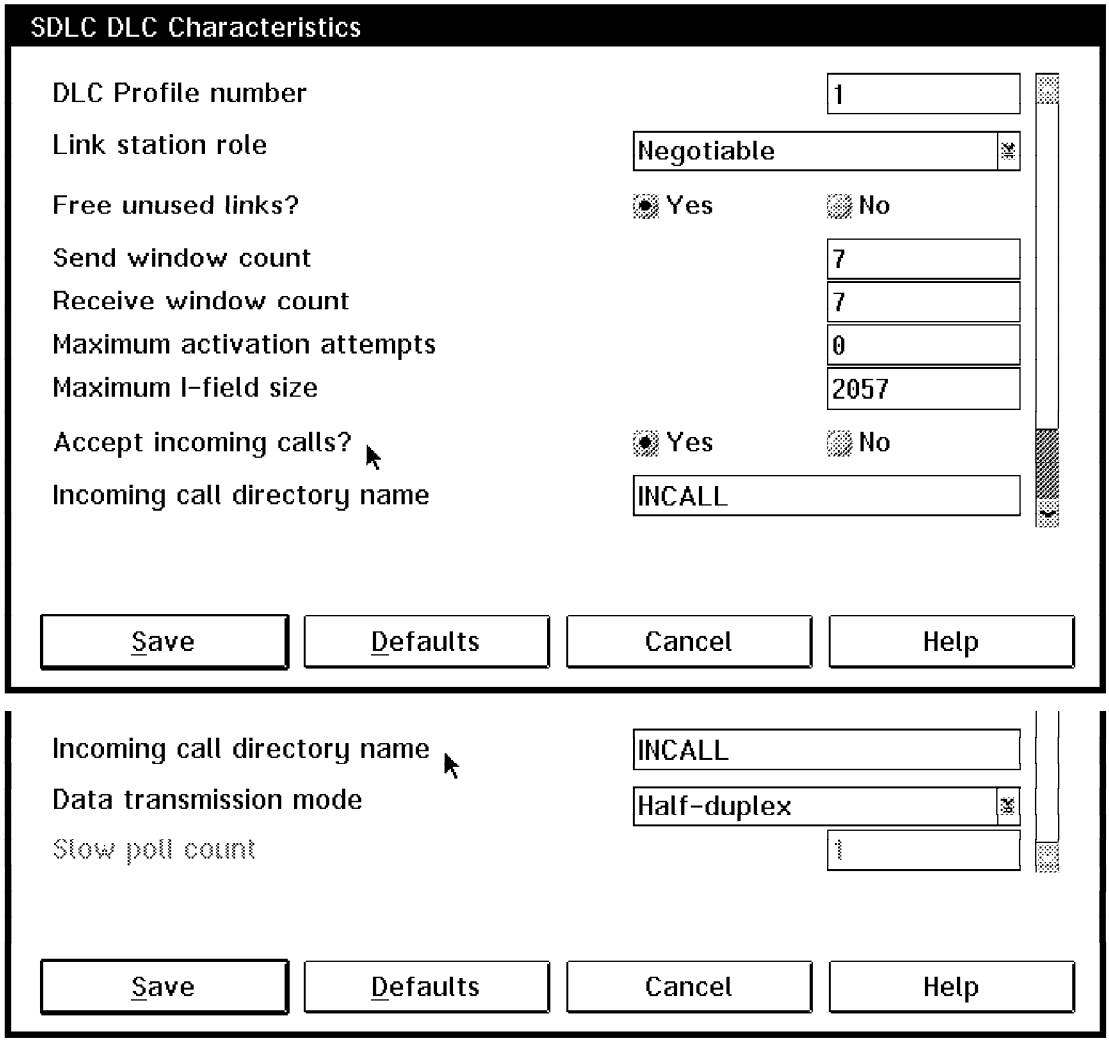


Figure 201. SDLC DLC Characteristics

11.2.2.3 ISDN Incoming Call Directory

When you enter the directory name here, you enable the directory to receive incoming calls.

Note

If Calling Party Phone Numbers are not specified, the IBM 2217 MpC accepts any calls.

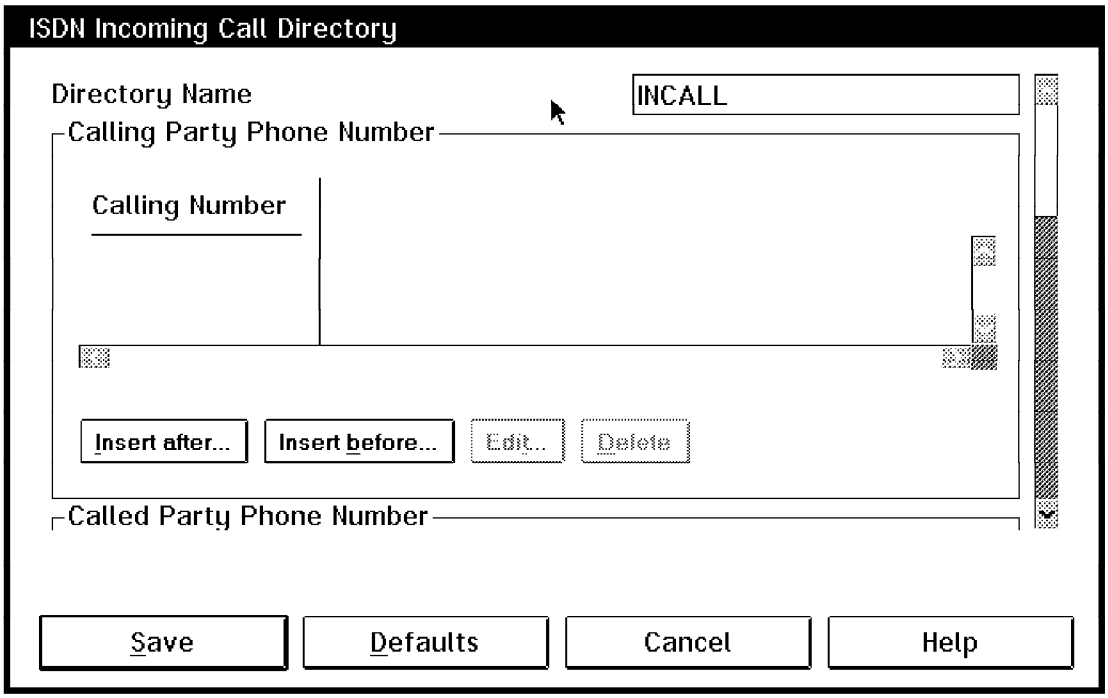


Figure 202. Incoming Call Directory

11.3 X.25 over ISDN Configuration

In this section, we show how to configure ISDN in order to support X.25 over ISDN (B or D-Channels). The following figure depicts this configuration:

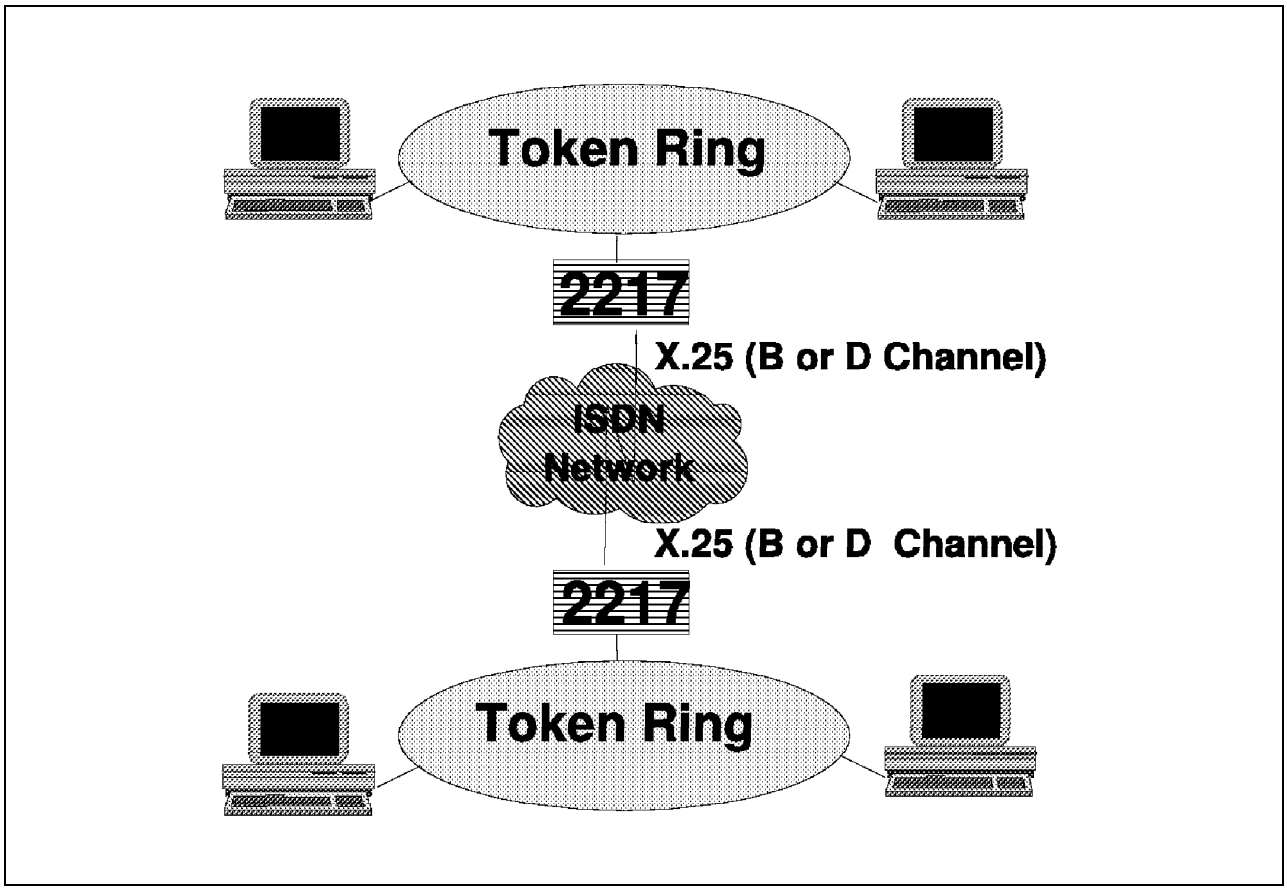


Figure 203. X.25 over ISDN Configuration

When you configure X.25 over ISDN you basically need to define the following profiles:

- **ISDN Adapter:** In this profile you configure the ISDN parameters obtained from your ISDN servicer provider.
- **X.25 SNA Link:** This profile is optional if you do not want to initiate the link from the IBM 2217 MpC. If you do not explicitly define a link, the IBM 2217 MpC will not be able to start the link activation procedure (XID exchange), but it can still accept incoming implicit links.
- **X.25 profile:** This profile is required. In this profile, specify the characteristics of the X.25 connection.
- **Switched:** This profile includes the ISDN outgoing and/or incoming directories.

Note

You can always configure an IBM 2217 MpC to support both incoming and outgoing calls. However, in this chapter we separate the configurations in order to better understand what is required.

The scheme shown in Figure 204 on page 263 illustrates the profiles you need to configure to initiate an X.25 over ISDN link.

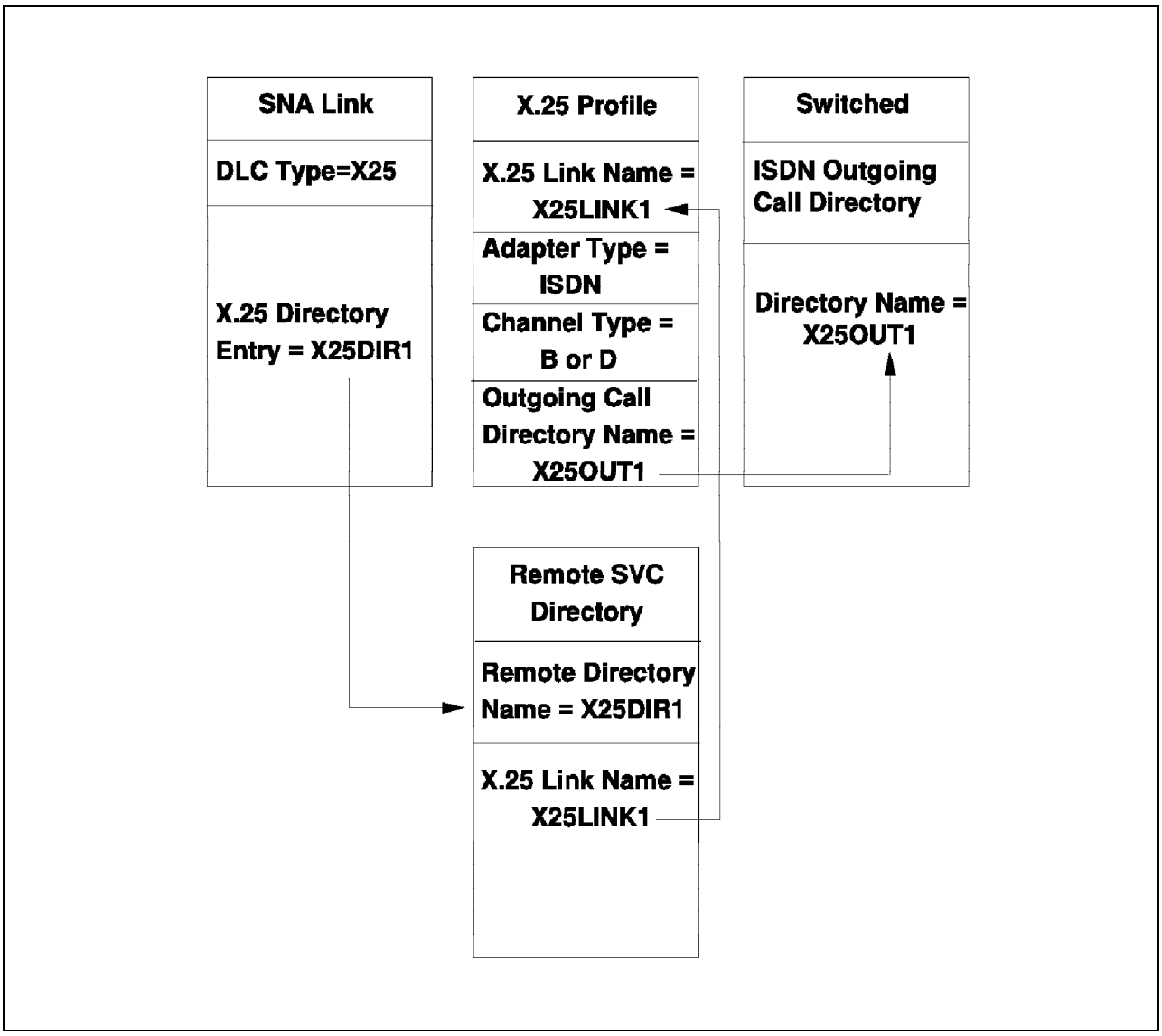


Figure 204. Initiating an X.25 over ISDN Connection

11.3.1.1 ISDN Adapter Configuration

In this configuration panel, enter the configuration values from your ISDN service provider subscription, such as the ISDN switch protocol, subscriber number, service provider identifiers and directory numbers.

In this panel, if you are configuring X.25 over ISDN D-Channel, you need to select the D-channel X.25 option and the X.25 TEI value obtained from your ISDN service provider.

For information about what you need to configure, please see 11.2.1.1, “ISDN Adapter Configuration (Local SDLC)” on page 254.

11.3.1.2 SNA Link (X.25)

If you want to be able to start the X.25 over ISDN link from the IBM 2217 MpC, you must configure an explicit link for X.25 (see Figure 205).

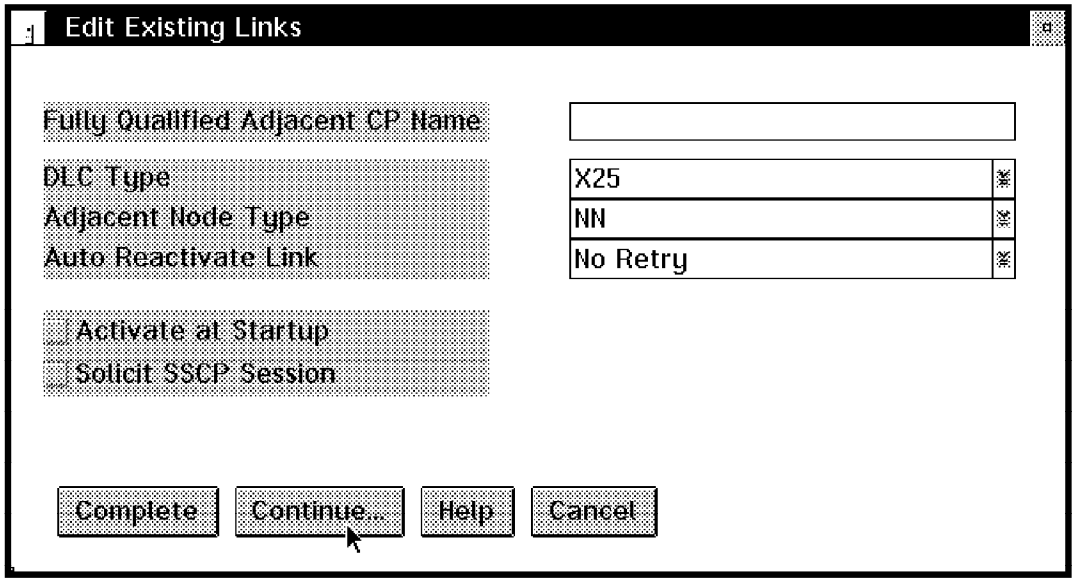


Figure 205. SNA Link (X.25)

Next, select **Continue...** to define additional link parameters and provide the X.25 directory entry name.

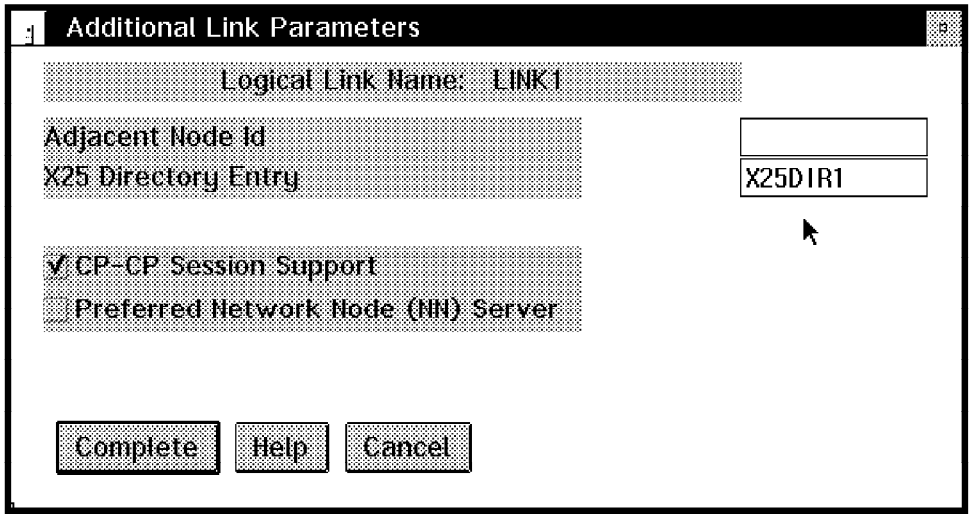


Figure 206. Additional X.25 Link Parameters

11.3.1.3 X.25 Profile

In these configurations panels, define the X.25 link characteristics. You will have to provide X.25 parameters such as:

- **X.25 link name:** In this configuration, we use X25LINK1.
- **Local DTE Address:** This field specifies the address assigned to your data terminal equipment (DTE) when you subscribed to the network.
- **Adapter type:** ISDN.
- **Channel type:** B or D channel.
- **Incoming call directory name:** Configure if accepting incomming calls.
- **Outgoing call directory name:** Required to start an X.25 over ISDN connection. In this configuration, we use X25OUT1.

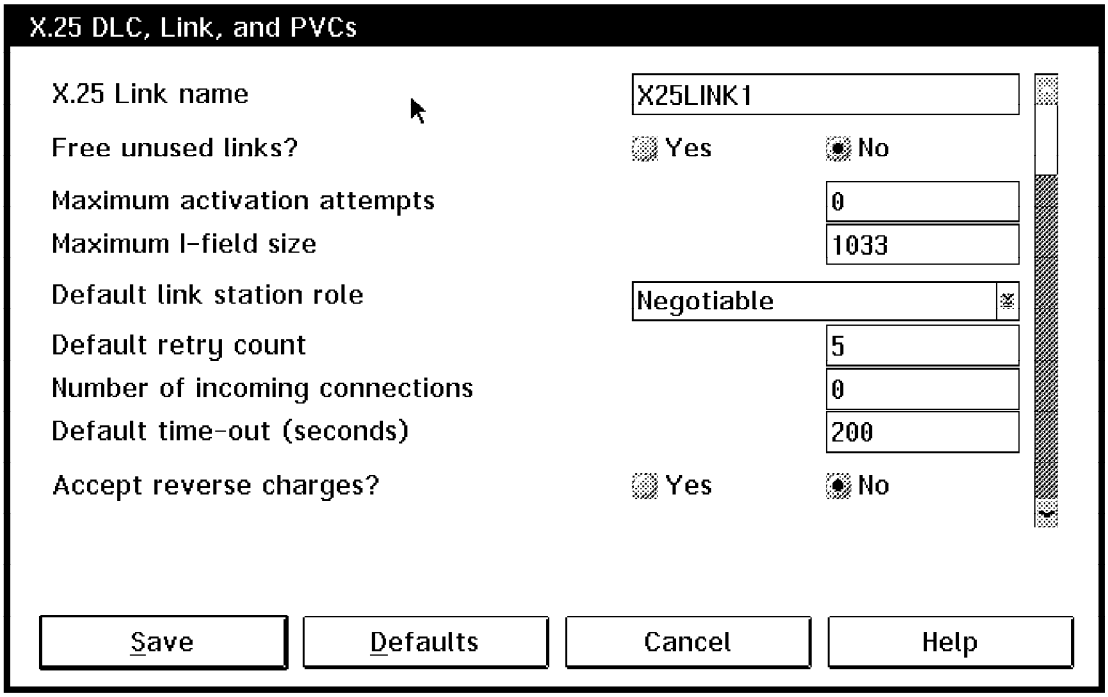


Figure 207. X.25 DLC Link (1 of 3)

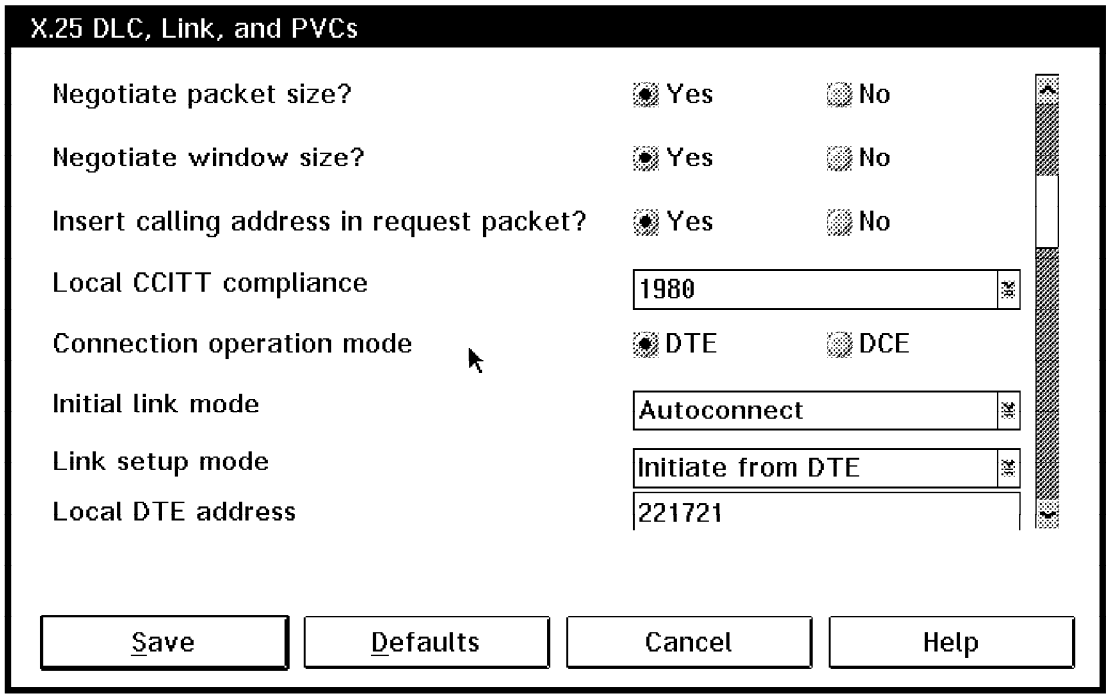


Figure 208. X.25 DLC Link (2 of 3)

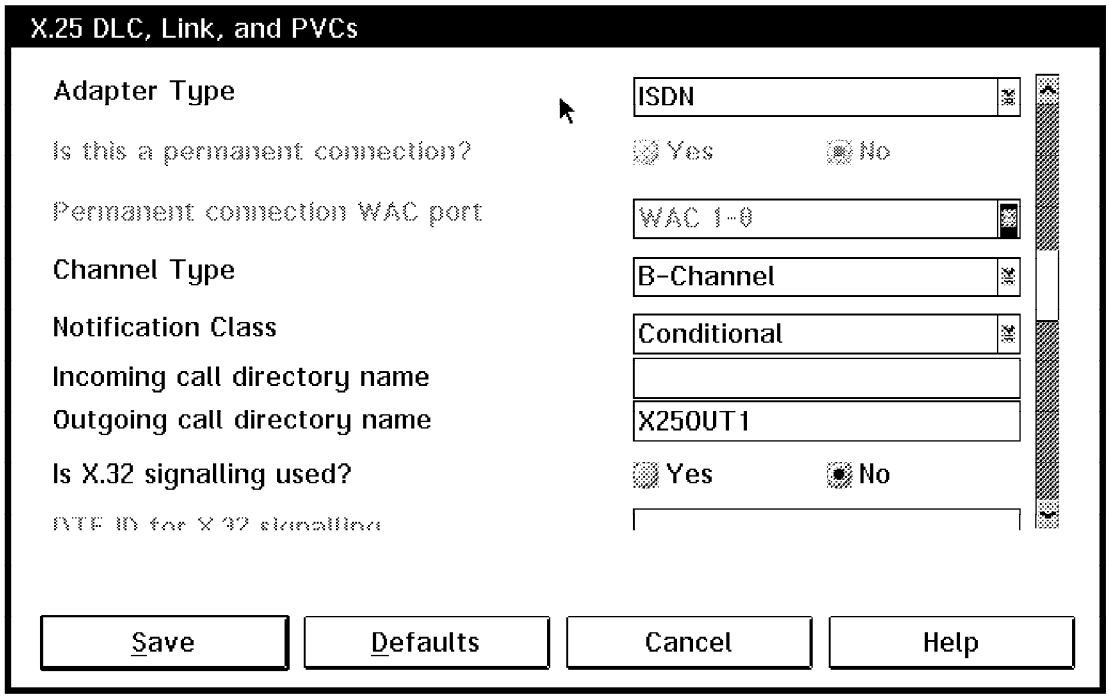


Figure 209. X.25 DLC Link (3 of 3)

11.3.1.4 X.25 Remote SNA SVC Directory

In the SNA X.25 folder, configure the remote SVC directory. For example:

- **Remote directory name:** Enter the name you specified in the SNA logical link definition.
- **X.25 link name:** Enter the name you specified in your X.25 profile.
- **Remote DTE address:** This field specifies the X.25 network address of the remote data terminal equipment (DTE) that your workstation communicates with.

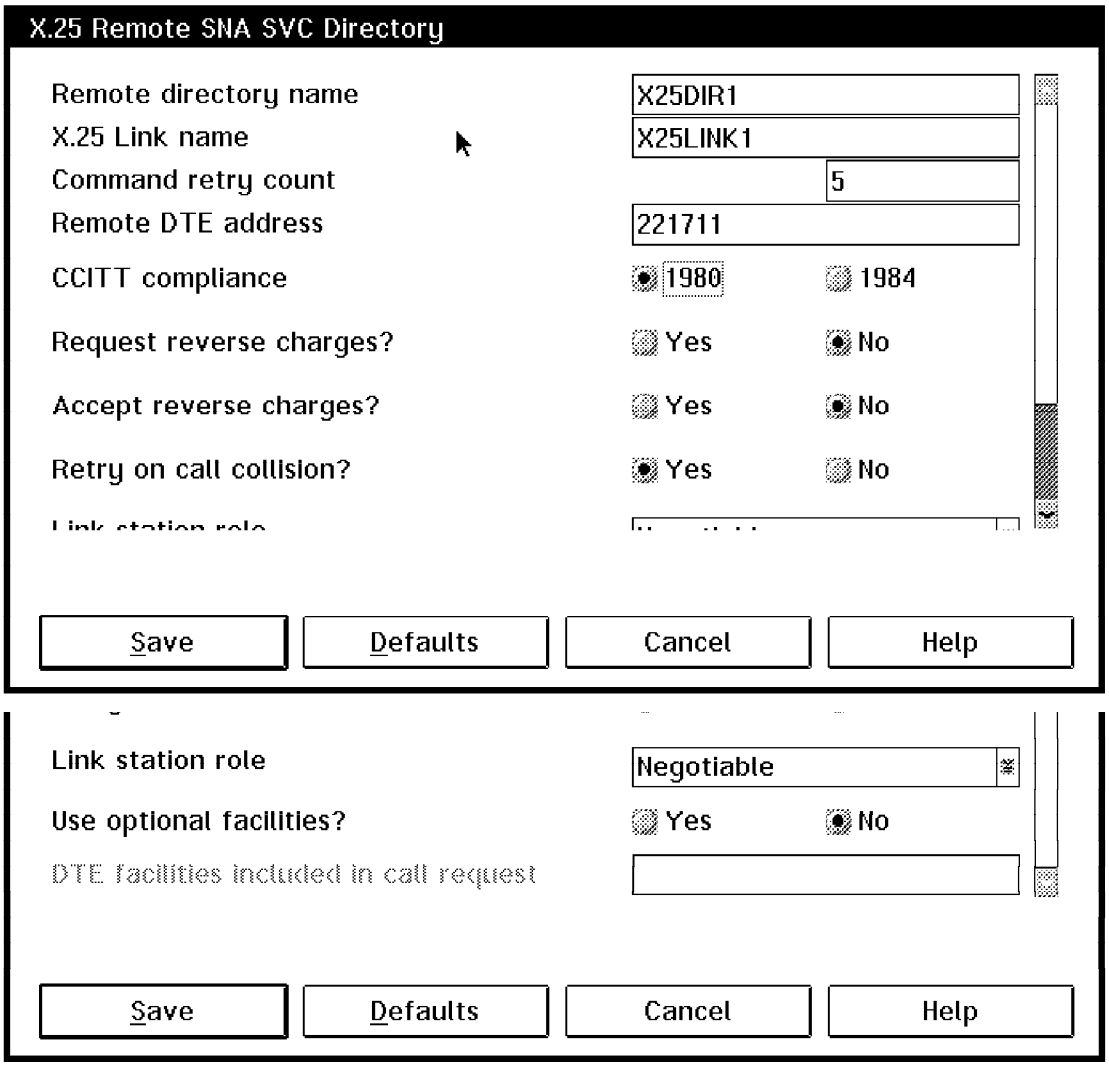


Figure 210. X.25 Remote SNA SVC

11.3.1.5 ISDN Outgoing Call Directory

In this panel you need to define the ISDN outgoing call directory to enter the number to be called. Select the **Switched** folder to get to this configuration panel. The directory name is specified in the X.25 profile previously defined. In this configuration it is X25OUT1.

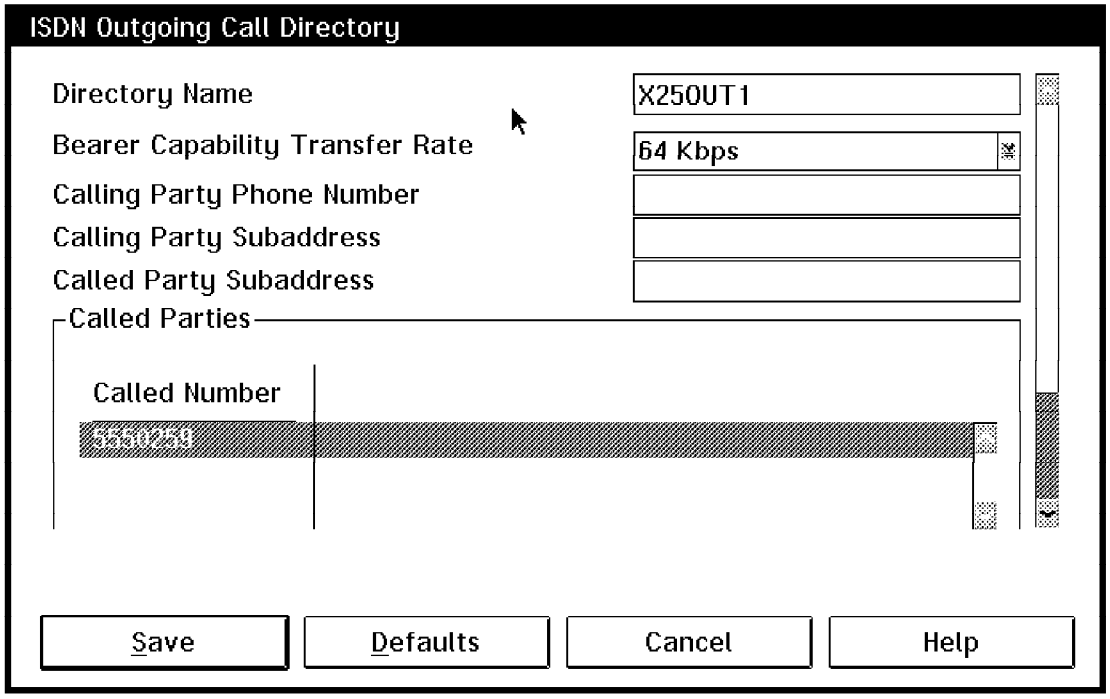


Figure 211. Outgoing Call Directory

11.3.2 Accepting an X.25 over ISDN Connection

In this section, we configure an IBM 2217 MpC to accept incoming calls. You can define an explicit SNA link. If an explicit link is not defined, IBM 2217 MpC will generate an implicit link. To verify what logical links are implicitly defined, you may want to display the IBM 2217 MpC logical links using the RCU Operations and Administration panels.

The following figure shown in Figure 212 on page 269 illustrates the profiles you need to configure in order to accept an SDLC over ISDN connection. As it was previously indicated, the SNA link profile is optional.

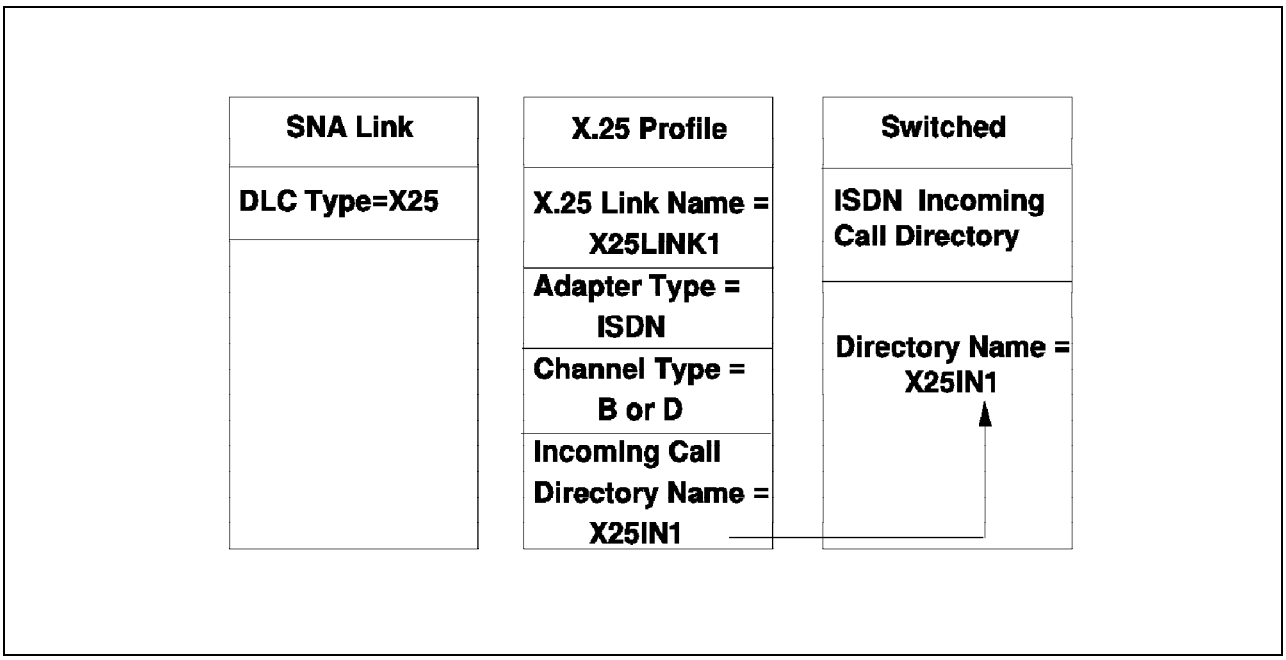


Figure 212. Accepting an X.25 over ISDN Connection (Explicit Link)

11.3.2.1 ISDN Adapter Configuration

In this configuration panel, enter the configuration values from your ISDN service provider subscription such as the ISDN switch protocol, subscriber number, service provider identifiers and directory numbers.

In this panel, if you are configuring X.25 over ISDN D-Channel, you need to select the D-channel X.25 option and the X.25 TEI value obtained from your ISDN service provider.

For information about what you need to configure, please see 11.2.1.1, “ISDN Adapter Configuration (Local SDLC)” on page 254.

11.3.2.2 SNA Links (X.25)

If you are only accepting incomming calls, you do not need to define an X.25 SNA logical link. In this case, the IBM 2217 MpC will take implicit links.

11.3.2.3 X.25 DLC Profile

Next, we configure the X.25 DLC profile.

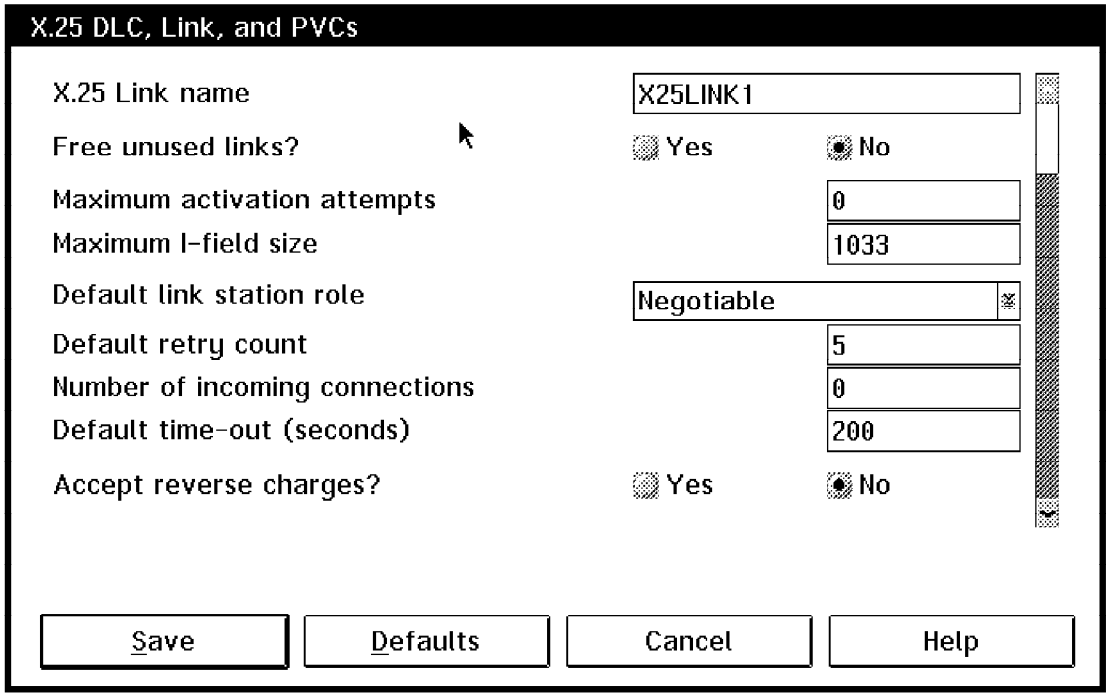


Figure 213. X.25 DLC Link (1 of 3)

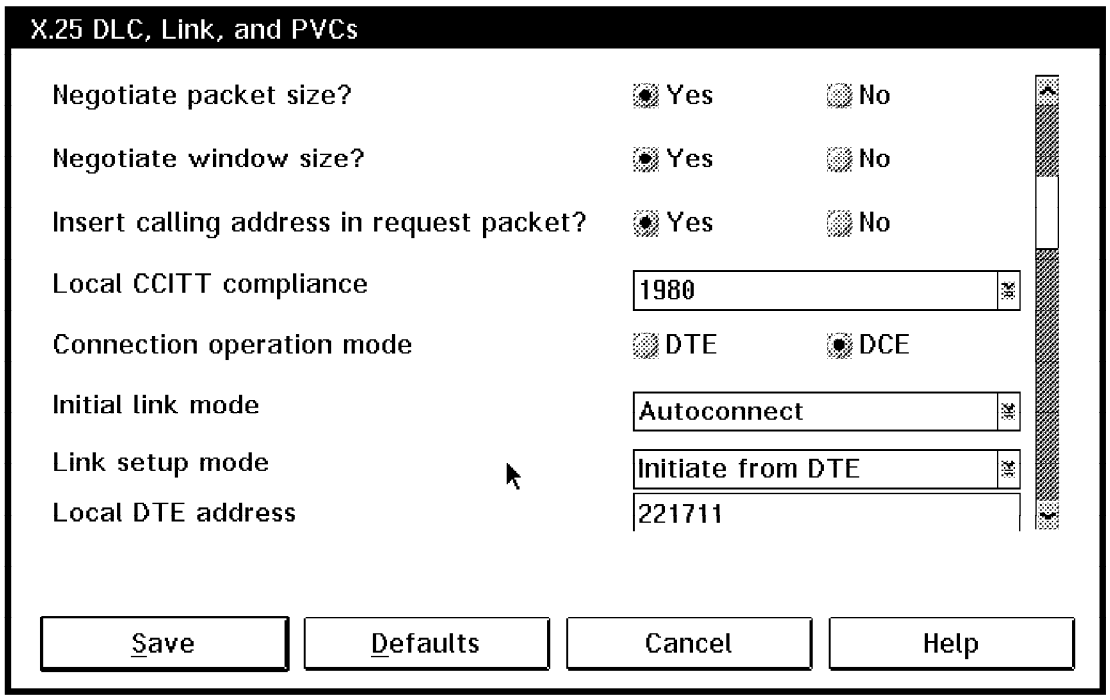


Figure 214. X.25 DLC Link (2 of 3)

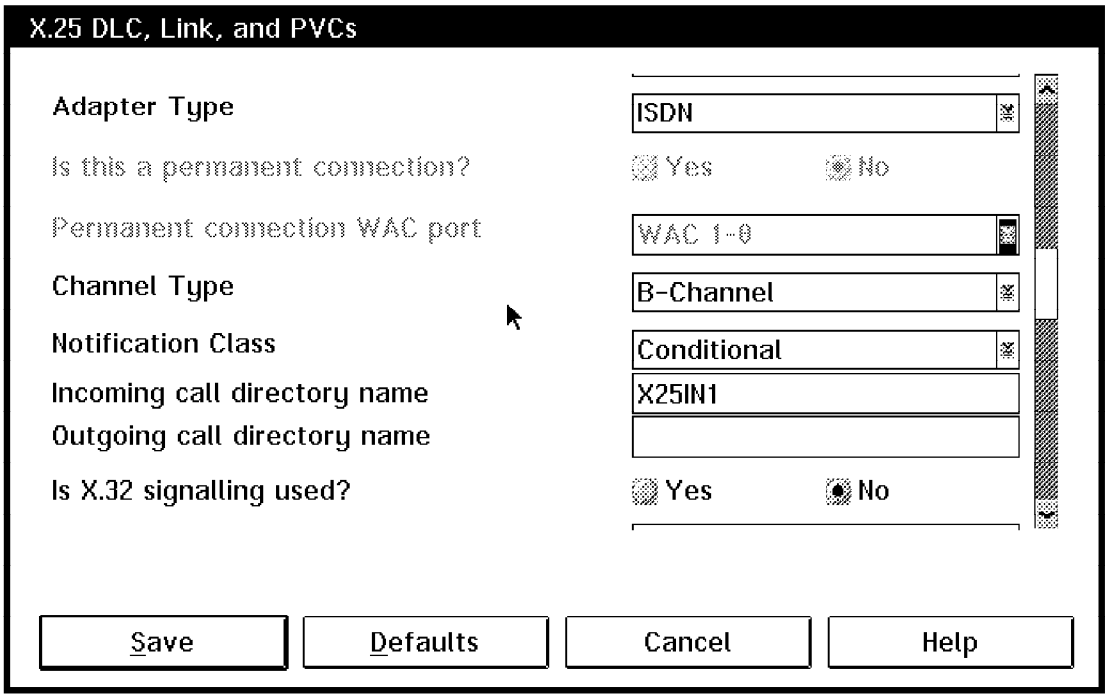


Figure 215. X.25 DLC Link (3 of 3)

11.3.2.4 ISDN Incoming Call Directory

When you enter the directory name in the Incoming Call Directory panel, you enable the directory to receive incoming calls.

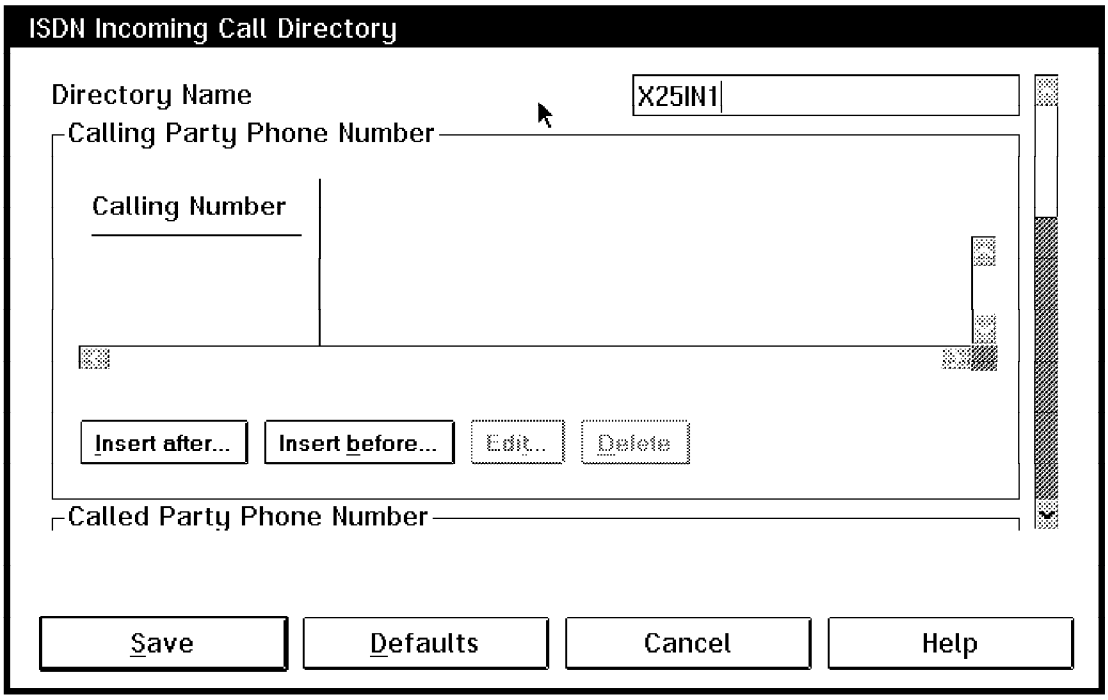


Figure 216. Incoming Call Directory

Note

By not entering a Calling Party Phone Number here the IBM 2217 MpC will answer all calls on the ISDN Adapter.

11.4 Using the 2217 RCU to Monitor and Troubleshoot ISDN Connections

This section explains how to use the 2217 RCU to monitor operations and troubleshoot problems for the ISDN connections.

For additional information on monitoring and troubleshooting SNA connections, see the *IBM 2217 Nways Multiprotocol Concentrator User's Guide*.

11.4.1 Verifying Initialization and Startup

Use messages in the LANTRAN.LOG file to verify that the initialization and startup occurred successfully. To view the LANTRAN.LOG file:

1. Click on the **RCU Operations and Administration** main menu option.
2. Click on the **Diagnostics** section tab.
3. Click on the **Execute** push button to view the LANTRAN.LOG file.

For an example of the LANTRAN.LOG file, see the *2217 Nways Multiprotocol Concentrator User's Guide*.

11.4.2 Obtaining Trace Data for ISDN Connections

Use the 2217 RCU to obtain trace data related to ISDN channel activity:

1. Click on the **Operations and Administration** main menu option.
2. Click on the **Diagnostics** section tab, then click on the **Tracing** tab.
3. Page forward to the ISDN trace panel.
4. Use the default number of seconds for the trace or change this value.
5. To start the trace, click on the **Execute** push button for one of the following traces:
   - All channels
   - First B-channel
   - Second B-channel
   - D-channel

   Note

   Once the trace is started, it cannot be stopped manually. The trace runs for the specified number of seconds.
6. After the trace time has elapsed, retrieve the trace output by clicking on the **Execute** push button. Trace data is recorded in the 2217ISDN.TRC file. Use the system editor to browse the 2217ISDN.TRC file.

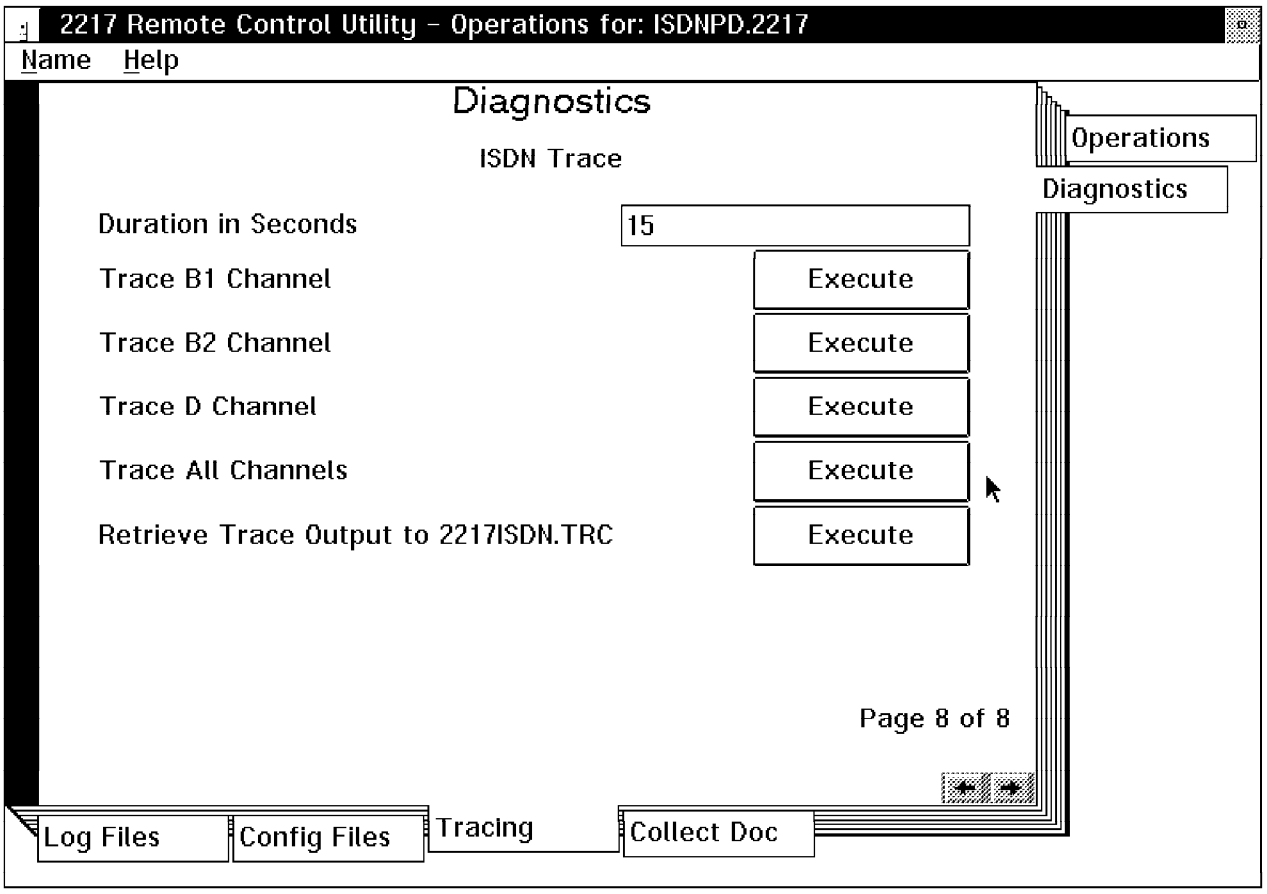


Figure 217. (ISDNPD01) Diagnostics Menu

11.4.3 Sample ISDN Traces

In this section, we show you a sample ISDN trace for selected SNA messages. Unfortunately, hexadecimal data is only interpreted in ASCII codes and you will not see the EBCDIC representation.

```
Rcv B1Chan - 14:37:31:880 - Sz:0100
         --------------- XID3 --------------------
    01 bf 32 62 05 d0 00 00 00 00 80 f7 c1 00 00 00 @ ..2b.............  SDLC+XID3
    00 80 15 01 0b 00 00 01 09 00 00 00 00 07 00 0e @ ................
    0e f4 e2 e3 c6 d5 c5 e3 4b c9 e2 c4 d5 f1 f1 0e @ ........K.......
    09 f7 7c c1 c1 c1 c1 c1 c1 c4 10 28 00 11 11 04 @ ..|........(....
    0e 02 f5 f6 f2 f1 f2 f5 f4 f0 f0 f2 f2 f0 16 11 @ ................
    03 13 00 11 f8 f5 f6 f5 f0 f0 f0 f0 f0 f0 f0 f0 @ ................
    f0 f0 f0 f0                                     @ ....
```

Figure 218. ISDN Traces - XID3

The next figure shows a trace entry for a Bind Request preceded by a TH (2f0001020003) and an RH (6b8100).

```
Rcv B1Chan - 14:37:32:060 - Sz:0149
         ------- TH ------ -- RH -- ----Bind Rq --
    01 10 2f 00 01 02 00 03 6b 81 00 31 00 13 07 b0 @ ../.....k..1....  SDLC+TH+RH+Bind Rq.
    b0 50 33 01 80 86 86 80 01 06 02 00 00 00 00 00 @ .P3.............
    00 40 1c 23 40 00 0d e2 e3 c6 d5 c5 e3 4b c9 e2 @ .@.#@........K..
    c4 d5 f1 f1 2e 00 08 02 c3 d7 e2 e5 c3 d4 c7 09 @ ................
    03 01 e4 de 7b 07 e4 de 7b 0e 04 e2 e3 c6 d5 c5 @ ....{...{.......
    e3 4b c9 e2 c4 d5 f1 f1 0a 13 00 10 8d 17 78 56 @ .K............xV
    bc 8b 1e 00 0d e2 e3 c6 d5 c5 e3 4b c9 e2 c4 d5 @ ...........K....
    f1 f0 60 16 c3 17 60 c0 b0 c2 cd 8a 0d e2 e3 c6 @ .. ... .........
    d5 c5 e3 4b c9 e2 c4 d5 f1 f1 2c 09 04 07 c3 d7 @ ...K......,.....
    e2 e5 c3 d4 c7                                  @ .....
```

Figure 219. ISDN Traces - Bind Request

Appendix A. Special Notices

This publication is intended to help networking specialists install IBM 2217 Nways MpC Release 2.0 machines. The information in this publication is not intended as the specification of any programming interfaces that are provided by the IBM 2217 Nways MpC Release 2.0. See the PUBLICATIONS section of the IBM Programming Announcement for IBM 2217 Nways MpC Release 2.0 for more information about what publications are considered to be product documentation.

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Appendix B. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

B.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “How To Get ITSO Redbooks” on page 279.

- *The Basics of IP Network Design*, SG24-2580
- *AS/400 in Multiprotocol Networks*, SG24-4522-00
- *IBM LAN Bridge and Switch Summary*, SG24-5000
- *IBM Communications Server for OS/2 Warp Version 4.0 Enhancements*, SG24-4587
- *A CM/2 APPC/APPN Tutorial*, GG24-2537
- *APPN Architecture and Product Implementation Tutorial*, GG24-3669-03 (available 2Q97)
- *MPTN Tutorial and Product Implementations*, SG24-4170
- *TCP/IP Tutorial and Technical Overview*, GG24-3376
- *LAN Concepts and Products*, Volumes I-IV, SG24-4753, SG24-4754, SG24-4755, SG24-4756

B.2 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 2-4 times a year at significant savings.

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System/390 Redbooks Collection	SBOF-7201	SK2T-2177
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RISC System/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

B.3 Other Publications

These publications are also relevant as further information sources:

- *2217 Nways Multiprotocol Concentrator User's Guide, Release 2*, GC30-3706-01
- *2217 Nways Multiprotocol Concentrator Planning Guide Release 2*, GA27-4996-01
- *2217 Nways Multiprotocol Concentrator Setup Guide Release 2*, GA27-4997

- *IBM Communications Server for OS/2 Warp, Version 4.0 - Up and Running!*, GC31-8189
- *MPTN Architecture: Technical Overview*, GC31-7073

How To Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, CD-ROMs, workshops, and residencies. A form for ordering books and CD-ROMs is also provided.

This information was current at the time of publication, but is continually subject to change. The latest information may be found at URL `http://www.redbooks.ibm.com`.

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  TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET ITSOCAT TXT
  TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET LISTSERV PACKAGE
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  To register for information on workshops, residencies, and redbooks:

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  TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ITSOREGI 1996
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- **Redbooks Home Page on the World Wide Web**

  `http://w3.itso.ibm.com/redbooks`

- **IBM Direct Publications Catalog on the World Wide Web**

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  Index # 4422 IBM redbooks
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Redbooks Home Page	http://www.redbooks.ibm.com
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- **Internet Listserver**

  With an Internet E-mail address, anyone can subscribe to an IBM Announcement Listserver. To initiate the service, send an E-mail note to `announce@webster.ibmlink.ibm.com` with the keyword `subscribe` in the body of the note (leave the subject line blank).

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List of Abbreviations

APA	all points addressable
IBM	International Business Machines Corporation
ITSO	International Technical Support Organization
PROFS	Professional Office System

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